Engineering Library

JUL 9 1925

With METALLURGICAL SUPPLEMENT.

The Engineer.

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VOL. CXXXIX.—No. 3626] • LONDON: FRIDAY EVENING, JUNE 26, 1925 [PRICE {WITH SUPPLEMENTS} ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

TO BUILDERS.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 8th July, 1925, for the INSTALLATION of LOW-PRESSURE HOT WATER HEATING SERVICE (forced circulation) and a SUMP PUMP at Brighton Sorting Office and Telephone Exchange.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities, forms for Tender, &c., may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners of H.M. Works, &c.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 9565

The Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for:—

VACUUM BRAKE FITTINGS for CARRIAGES and WAGONS.

Tenders due on the 10th July, 1925.
Tender forms obtainable from above. 9587

The High Commissioner for India is prepared to receive TENDERS for the SUPPLY of:—

FOUR STEAM COALING CRANES, to lift 1½ tons at 25ft. radius.

TWIN-SCREW STEAM HOPPER DRAG and CUTTER SUCTION DREDGER with 30in. Pipe Line.

COMBINED ROCK BREAKING VESSEL and DIPPER DREDGE.

Forms of Tender may be obtained from the DIRECTOR-GENERAL, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, and Tenders are to be delivered at that office not later than Two o'clock p.m. on Tuesday, 14th July, 1925, for No. 1, and on Friday, 24th July, 1925, for Nos. 2 and 3. 9586

Civil Service Commission. FORTHCOMING EXAMINATION. PROBATIONARY ASSISTANT ENGINEER in the Engineering Department of the General Post Office (20-23, with extension in certain cases).—Regulations and particulars are obtainable from the SECRETARY, Civil Service Commission, Burlington-gardens, London, W. 1, together with the form on which applications must be made. The latest date for the receipt of application forms is 30th July. 9566

Executive Engineers (3) REQUIRED by the GOVERNMENT of the GOLD COAST for the PUBLIC WORKS DEPARTMENT, for a tour of 12 to 18 months' service, with possible extension. Salary £480 a year for the first three years of service, then £510, rising to £720 a year by annual increments of £30, and thence rising to £920 a year by annual increments of £40. Free quarters and passages, and liberal leave on full salary. Outfit allowance of £60 on first appointment. Candidates, age 25 to 35, should have been trained as Architects or Civil Engineers, and be capable of taking entire control of the Construction of Concrete and other Buildings; a knowledge of Quantities and Measuring-up is essential. Students or Associate Members of the Institution of Civil Engineers preferred.—Apply at once by letter, stating age, qualifications and experience to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, S.W. 1, quoting M/13,740. 9532

Reinforced Concrete Designers and DETAILERS REQUIRED, with good knowledge and experience in the calculations and details for Reinforced Concrete Buildings.

Candidates should have had a good theoretical training and be capable of making the necessary calculations and working details of the reinforced concrete construction from architects' drawings, and must have served in H.M. Forces during the war.

Applications in writing not later than July 6th, with copies of not more than three recent testimonials and stating particulars of training, experience, age, salary required, and service in H.M. Forces, should be addressed to the ESTABLISHMENT OFFICER, H.M. Office of Works, Storey's-gate, Westminster, S.W. 1. 9568

Sanitary Engineer REQUIRED by the GOVERNMENT of the TANGANYIKA TERRITORY for the PUBLIC WORKS DEPARTMENT. Salary £700, rising to £800 a year by annual increments of £25, to be engaged in the first instance for a tour of 20-30 months' service, with prospect of the appointment becoming permanent after two tours of service if re-engaged for the second. Free quarters and passages and liberal leave on full salary. Candidates, not over 40 years of age, must be Associate Members of the Institution of Civil Engineers or hold equivalent professional qualifications and have had at least 5 years' experience in the actual charge of the construction and maintenance of water and sewage works. Must be fully conversant with the latest methods of mechanical filtration and be capable of carrying out detailed plans and estimates in connection with water supply and sewage schemes, both gravitation and pumping.—Apply at once by letter, stating age and giving brief details of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, S.W. 1, quoting M/13,449. 9559

Structural Steelwork Designers REQUIRED, with good knowledge and experience in the calculations and details for all types of steel-framed office and public buildings.

Candidates should have had good theoretical training and be capable of preparing steel work schemes from architects' drawings and must have served in H.M. Forces during the war.

Applications in writing not later than July 6th, with copies of not more than three recent testimonials and stating particulars of training, experience, age, salary required, and service in H.M. Forces, should be addressed to ESTABLISHMENT OFFICER, H.M. Office of Works, Storey's-gate, Westminster, S.W. 1. 9567

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Metallurgical Supplement.

The British Steam Railway Locomotive from 1825 to 1924—No. 26.

Waterloo Temporary Bridge (With a Two-Page Supplement).

The Queen Mary Reservoir at Littleton—(No. II.).

New Locomotives for the L. & N.E.R.

Dry Weather Flows of Streams.

Electric Railway Standardisation.

The International Railway Congress—No. IV.

United States Patents in 1924.

The Centenary of Railways

THE MOST COMPLETE

History of the Steam Railway Locomotive from 1825 to 1925

which has ever been written is now appearing in

The Engineer

PART 1 WAS PUBLISHED ON JAN. 2nd.

and the articles have been printed week by week since that date.

Back numbers are obtainable by application to the Publisher, 33, Norfolk Street, Strand.

The Engineer, which is now in its 70th year, has always devoted much attention to railways and locomotives. In its first issue, Jan. 4th, 1856, it described Ritchie's Locomotive with Opposed Pistons.

PUBLIC NOTICES

University College, Southampton.

The College offers excellent opportunities for training in CIVIL, MECHANICAL and ELECTRICAL ENGINEERING.

Courses are provided in preparation for:—B.Sc. (Engineering), University of London; Membership of Professional Institutions; College Diploma, and Practical Engineering.

The next session commences on Monday, 5th October. Early application should be made to the REGISTRAR for "Handbook of the Faculty of Engineering," "Engineering Scholarships" and "Calendar." 9558

Bradford Education Committee.

TECHNICAL COLLEGE.

APPLICATIONS are INVITED for APPOINTMENT as HEAD of the DEPARTMENT of MECHANICAL ENGINEERING in the College.

A salary up to £700 per annum may be paid to a candidate of suitable qualifications and experience.

Full particulars of the appointment and forms of application may be obtained from the Principal of the College, to whom applications should be returned completed not later than Friday, 3rd July, 1925.

N. L. FLEMING,
9479 Town Clerk.

Egyptian State Railways, Telegraphs and Telephones.

LIST OF APPROVED MANUFACTURERS OF CERTAIN SUPPLIES TO THE ABOVE ADMINISTRATION.

The said List is now under revision and all manufacturers who are interested, WHETHER PREVIOUSLY APPROVED OR NOT, are hereby invited to obtain further information either by application to the

GENERAL MANAGER,
Egyptian State Railways, Telegraphs and Telephones, Cairo,

or by subscribing to the "EGYPTIAN RAILWAY ADVERTISER."

This "Advertiser" is a weekly publication, in Arabic, English, and French. Subscription Fifty Egyptian Piastres or Ten Shillings and sixpence yearly.

It is an organ of the Egyptian State Railways, Telegraphs and Telephones, containing information of interest to manufacturers, contractors and suppliers of materials and stores used by the Administration.

For particulars or registration of subscriptions apply to

PUBLICITY SECTION,
Egyptian State Railways, Telegraphs and Telephones,
9057 Cairo (Egypt).

Administrative County of LONDON.

BEVERLEY BROOK RELIEF CULVERT.

The London County Council invites TENDERS for the CONSTRUCTION of about 2256 lineal feet of 8ft. by 8ft. CONCRETE CULVERT, from the Beverley Brook, near Priests Bridge, Upper Richmond-road, to the south bank of the River Thames, about 800 lineal feet above Barnes Bridge (Southern Railway, L. and S.W. section), including an Inlet Weir at the head of the culvert, a Flap Chamber and Outlet Apron on the south bank of the River Thames, and the Diversion of Local Sewers. The new works will be situate almost entirely in the urban district of Barnes in the County of Surrey.

Persons desiring to submit Tenders may obtain the form of Tender and contract, specification, bill of quantities and drawings on application to the Chief Engineer of the Council at the Old County Hall, Spring-gardens, S.W. 1, upon payment of the sum of £10. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after Twelve Noon on Tuesday, 21st July, 1925, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
9535 Clerk of the London County Council.

H. and T. Danks (Netherton) Ltd., Netherton, Dudley, Manufacturers of Boilers and Superheaters (no connection with any other firm of boilermakers), are OPEN to APPOINT a competent MAN—or FIRM—to REPRESENT them in South Wales.—Applications in first instance to be addressed to the SECRETARY, giving fullest information as to qualifications. 9572

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PUBLIC NOTICES

Bengal-Nagpur Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for :—

100 OPEN and 100 COVERED GOODS WAGON UNDERFRAMES and BODIES (WITHOUT BOGIES and WHEELS and AXLES).

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 25th June, 1925.

A fee of 20s. will be charged for the specification, which is not returnable.

Tenders must be submitted not later than Noon on Thursday, 9th July, 1925.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
R. C. VOLKERS,
Secretary.

9560

Cardiff Corporation Waterworks.

TAFF FAWR SECTION.

PIPE LINE No. 2.—CONTRACT No. 4.

The Cardiff Corporation is prepared to receive TENDERS from competent and experienced persons, whose names are on the King's Roll, for the CONSTRUCTION, LAYING and COMPLETION of the No. 2 PIPE LINE, Second Section, and other works in connection therewith.

The line of pipes will commence on the disused Glamorganshire Canal, about one mile north of Abercynon, and terminate in Llanishen Reservoir, in the City of Cardiff, a length of approximately 14 2-3 miles of 31in., 25in., and 24in. diameter Lap-welded Steel Tubes, Concrete-lined. One Break Pressure Tank, together with several Bridges and Subways and Two Houses.

Drawings may be seen and printed specification, form of Tender and bill of quantities may be obtained, on application to Mr. C. H. Priestley, M. Inst. C.E., City Hall, Cardiff, after the 29th day of June, on payment of a deposit of £20 to the City Treasurer, which will be returned after the receipt of a bona fide Tender, with the bill of quantities fully priced out and the specification attached, but on that condition only.

Sealed Tenders, addressed to the Town Clerk, City Hall, Cardiff, and endorsed "Tender for No. 2 Pipe Line, Taff Fawr Section," are to be delivered not later than Twelve Noon on the 18th day of July, 1925.

The Corporation do not bind themselves to accept the lowest or any Tender.

No person should tender unless he be properly qualified by practical skill and experience acquired as a master contractor in the construction of extensive public works.

Persons proposing to tender are requested to send in their names at once to the Engineer, giving particulars of contracts carried out by them, and they must be prepared to go over the intended route of the pipe line with the Engineer before the Tenders are sent in.

Dated this 23rd June, 1925.

CECIL G. BROWN,
Town Clerk.

9547

City and County of Kingston-upon-Hull.

WATERWORKS.

COTTINGHAM PUMPING STATION.

CONTRACT NO. C.1.

The Water and Gas Committee of the Corporation of Kingston-upon-Hull invite TENDERS for the CONSTRUCTION of the UNDERGROUND WORKS required in the enlargement of the existing Pumping Station at Cottingham, in the East Riding of Yorkshire.

The works to be executed include the Removal of existing Pumping Machinery, the Deepening of Three Wells, the Deepening of Ten Shafts, in chalk, and the Construction of Five New Shafts in chalk covered with drift, the Driving of 4200ft. of Adits at a depth of 120ft. below ground level, and the Sinking of Twelve Bores. The quantity of water to be raised from the workings during construction will probably exceed 15 million gallons a day.

The drawings may be inspected and specifications, schedule of quantities, and form of Tender obtained on application to the undersigned. A deposit of Five Pounds in Bank of England or Treasury notes is required and will be returned on receipt of a bona fide Tender.

Tenders, endorsed "Cottingham Works," are to be addressed to the Chairman of the Water and Gas Committee and delivered at the Town Clerk's office not later than Tuesday, 14th July, 1925.

By Order,
CHARLES B. NEWTON,
Engineer.

Guildhall, Hull,
15th June, 1925. 9497

County Borough of Bolton.

WATERWORKS DEPARTMENT.

PUMPING PLANT—LOWER HEIGHT WELL.

TENDERS are INVITED for SUPPLYING, ERECTING and SETTING to WORK a HEAVY-OIL ENGINE DRIVEN BORE-HOLE PUMPING PLANT having a capacity of 700 gallons per minute from a depth of 365ft. below the intended engine-house floor to a level of about 2ft. below that floor, and other PLANT in connection therewith, at the Lower Height Well, in the township of Belmont, near Bolton.

The instructions to persons tendering and other contract documents may be seen on application at the office of Mr. John K. Swales, M. Inst. C.E., Waterworks' Engineer, 8t, George's-street, Bolton, and copies thereof may be obtained on the deposit of Three Guineas, which will be returned to tenderers who have submitted a bona fide Tender and returned all the documents supplied.

Tenders are to be submitted in accordance with the "Instructions to Persons Tendering" above referred to before 10 a.m. on the 20th July, 1925.

SAMUEL PARKER,
Town Clerk.

Town Hall, Bolton,
22nd June, 1925. 9540

County Borough of Tynemouth.

CORPORATION QUAYS, NORTH SHIELDS.

TENDERS are INVITED for the CONSTRUCTION (in Timber Work) of WAVE-BARRIER, &c., at the Protection Jetty. Drawings may be seen, and upon payment of Two Guineas, copies of specification and schedule of quantities may be obtained at the office of the undersigned. The receipt of a bona fide Tender from anyone making payment as aforesaid will ensure the return of the sum paid.

Tenders, endorsed "Tender for Wave-Barrier, &c.," are to be delivered to the undersigned by, at latest, 10 a.m. on Friday, the 10th July, 1925.

No pledge is given to accept the lowest or any Tender.

JOHN F. SMILLIE,
Borough Surveyor.

Borough Surveyor's Office,
North Shields,
22nd June, 1925. 9541

Metropolitan Water Board.

SUPPLY OF POSITIVE TYPE WATER METERS.

The Metropolitan Water Board invite TENDERS for the SUPPLY of 250 4in., 250 2in., 150 1in., and 100 ¾in. POSITIVE TYPE WATER METERS, to be delivered to the Board's works at Amwell-street, Clerkenwell, E.C. 1.

Forms of Tender may be obtained from the Chief Engineer by personal application (Room 156), or upon forwarding a stamped addressed brief envelope.

Tenders, on the official form, addressed to the "Clerk of the Board," Metropolitan Water Board, 173, Rosebery-avenue, E.C. 1, endorsed "Tender for Water Meters," must be delivered at the offices of the Board not later than 11 a.m. on Friday, 3rd July, 1925.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

173, Rosebery-avenue, E.C. 1,
23rd June, 1925. 9557

PUBLIC NOTICES

County Borough of Brighton.

WATERWORKS DEPARTMENT.

TO MAIN-LAYING CONTRACTORS.

The Waterworks Committee are prepared to receive TENDERS from responsible contractors for LAYING about 2520 YARDS of 18in. and about 1780 YARDS of 16in. CAST IRON MAINS in Ditchling-road, Hollingbury-road, Hollingdean-road, Old-lane, and Surrenden-road, Brighton.

Specification, quantities, and form of Tender may be obtained and drawings inspected on application to Mr. A. B. Cathcart, M. Inst. C.E., Waterworks Engineer, 12, Bond-street, Brighton, on payment of a deposit of Three Guineas, which will be refunded upon receipt of a bona fide Tender not subsequently withdrawn and the return of all documents.

Sealed Tenders, endorsed "Tender for Laying 18in. and 16in. Water Mains," to be delivered at my office, Town Hall, Brighton, not later than Noon on Monday, July 6th, 1925.

The lowest or any Tender will not necessarily be accepted, and Tenders will only be considered from responsible contractors having the necessary experience.

JAS. H. ROTHWELL,
Town Clerk.

Town Hall, Brighton,
10th June, 1925. 9450

County Borough of Brighton.

WATERWORKS DEPARTMENT.

TO PIPE FOUNDERS.

The Waterworks Committee invite TENDERS for the SUPPLY of about 360 TONS of 16in. diameter, Class "C," 240 TONS of 18in. diameter, Class "B," and about 320 TONS of 18in. diameter, Class "C" CAST IRON PIPES to the British Standard Specification, together with SPECIALS of both diameters, delivered in Brighton.

Specification and form of Tender may be obtained from the Waterworks Engineer, Mr. A. B. Cathcart, M. Inst. C.E., 12, Bond-street, Brighton, upon payment of a deposit of Two Guineas, which will be refunded upon receipt of a bona fide Tender not subsequently withdrawn.

Sealed Tenders, endorsed "Tender for C.I. Pipes," to be delivered at my office, Town Hall, Brighton, not later than Noon on Monday, July 6th, 1925.

The Committee do not bind themselves to accept the lowest or any Tender.

JAS. H. ROTHWELL,
Town Clerk.

Town Hall, Brighton,
10th June, 1925. 9451

County of London.

REPAVING OF CARRIAGEWAYS.

The London County Council invites TENDERS for the TAKING UP and REMOVAL of the EXISTING PAVING of the CARRIAGEWAY, the MAKING GOOD (where so required) and RENDERING of the EXISTING CONCRETE FOUNDATION, also the REPAVING with CREOSOTED WOOD BLOCKS and other incidental works, of—

(a) Part of NORTHUMBERLAND-AVENUE, adjoining the Victoria Embankment; and

(b) VAUXHALL BRIDGE and APPROACHES.

Persons desiring to submit Tenders for either or both of these works may obtain the specifications, bills of quantities, forms of Tender and contract, &c., on application to the Chief Engineer of the Council, at the Old County Hall, Spring-gardens, S.W. 1, upon payment in each case of the sum of £3. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the works may be obtained on personal application, and the contract documents may be inspected before payment of the fees.

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 13th July, 1925, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
Clerk of the London County Council.

9556

DRY-DOCKING, &c., OF R.A.S. "WHITE CROSS."

The Metropolitan Asylums Board

invite TENDERS for DRY-DOCKING and REPAIRING the HULL and FITTINGS of the RIVER AMBULANCE STEAMER "WHITE CROSS."

Specifications, conditions of contract and form of Tender may be obtained at the office of the Board, Victoria Embankment, London, E.C. 4.

Tenders, addressed as noted on the form of Tender, must be delivered at the Office of the Board not later than 10 a.m. on Wednesday, 15th July, 1925.

G. A. POWELL,
Clerk to the Board.

9552

The South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. STEEL TYRES for LOCOMOTIVE ENGINES and TENDERS.
2. LEATHER BELTING, HIDES, &c.
3. MISCELLANEOUS ARTICLES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Steel Tyres," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 10th July, 1925.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of Specifications Nos. 1 and 2, and 10s. for each copy of Specification No. 3.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
24th June, 1925. 9583

Waltham Holy Cross Urban

DISTRICT COUNCIL.

The above Council is prepared to receive TENDERS for SUPPLYING and ERECTING at the proposed New Pumping Station at Upshire a 3in. VERTICAL-SPINDLE MOTOR-DRIVEN CENTRIFUGAL SEWAGE PUMP with Automatic Control Gear complete.

Further particulars will be sent by the undersigned on receipt of a stamped addressed foolscap envelope.

Tenders, sealed and endorsed "Tender for Sewage Pump," must be in the hands of F. C. E. Jessopp, Esq., Clerk to the Council, Waltham Abbey, by Five o'clock p.m. on Monday, the 20th July, 1925.

The Council does not bind itself to accept the lowest or any Tender.

W. C. HOLLOWAY,
Engineer and Surveyor.

Town Hall, Waltham Abbey,
June 23rd, 1925. 9564

City of Oxford.

CHIEF ENGINEMAN.

The Corporation of Oxford invite APPLICATIONS from skilled Mechanics for the APPOINTMENT of CHIEF ENGINEMAN at their Waterworks Pumping Station, Hinksey, Oxford.

Preference will be given to those having experience in the construction and management of "Worthington" and Rotary Pumping Engines.

Wages £4 per week, with house, coal, and gas free.

Further particulars can be obtained from the City Engineer, Town Hall, Oxford.

Applications, in candidates' own handwriting, enclosing not more than three recent testimonials, stating present employment, past experience, age, and whether married or single, must be delivered to me not later than Saturday, July 4th, marked on the envelope "Chief Engineman."

The successful candidate will be required to contribute under the Local Government and other Officers' Superannuation Act, 1922, and to pass a medical examination.

Canvassing members of the Council will disqualify.

A. HOLT,
Town Clerk.

Town Clerk's Office, Oxford,
19th June, 1925. 9483

PUBLIC NOTICES

Chiltern Hills Spring Water CO., AYLESBURY.

WANTED, ASSISTANT ENGINEER, not under 30 years of age, married; must have had experience of large Deep Well Pumping Plants, also of High-pressure Pumping and Service Mains.

Salary, £250 per annum, rising to £300 by two yearly increments of £25.

Write, giving age and full particulars of experience, &c.

H. A. CALLON,
Manager.

9581

Karachi Port Trust.

A MECHANICAL ENGINEER is REQUIRED by the Trust for service at Karachi, India.

Candidates must be not more than 35 years of age, preferably holding a Board of Trade Certificate. They must be thoroughly trained Mechanics, able to Take Charge of Construction Plant, Goliath, Electric and other Cranes, and the General Plant of a large wharf, both while under construction and also after the berths are open.

SALARY.—Rupees 600, rising by annual increments of Rs. 25 to Rs. 700 per calendar month, without any allowances.

TERMS.—A five years' agreement in the first instance, second-class free passage to Karachi and home again on satisfactory termination of services.

Applicants must send their replies AT ONCE, giving full particulars as to age, whether unmarried, and a record of their career (with dates), in chronological order, showing how and where they have been employed, and class of work performed at each place to—

RENDEL PALMER and TRITTON,
Appointments Dept.,
13, Dartmouth-street,
Westminster, S.W. 1. 9554

Madras and Southern Mahratta RAILWAY COMPANY, LTD.

VACANCY FOR OFFICER IN STORES DEPARTMENT.

WANTED, DISTRICT CONTROLLER of STORES, Senior Scale, age 30 to 35 years, may be married, must have good educational qualifications, have a good knowledge and previous experience of Railway Stores Procedure, Stores Purchase Rules, Commercial Buying and Selling, and be a trained correspondent.

Desirable knowledge: Mechanical engineering, shipping law, marine insurance, Indian law, and court procedure.

SALARY.—Rs. 700 to Rs. 1200 per month, according to qualifications, with increases on promotion. Required in India immediately.

TERMS.—Subject to a strict medical examination by the Company's Consulting Physician, a three years' agreement in the first instance, a first-class free passage to India and home again on satisfactory termination of agreement, which is extensible by mutual consent. Employees are required to subscribe one month's pay yearly to the Company's Provident Fund, and to those of over five years' service a bonus equal to their contribution is credited, both bonus and contribution accumulating at compound interest until retirement.

Applications, with copies (not originals) of testimonials, should be made by letter only and addressed to the undersigned not later than 6th July, 1925. Details must be given in chronological order with dates of general and technical education and practical experience, if any. Special forms of application will be sent to candidates who appear to have the necessary qualifications.

By Order,
C. L. MAGNIAC,
Brig.-General,
Secretary.

25, Buckingham Palace-road,
Westminster, S.W. 1,
19th June, 1925. 9545

South Indian Railway Company, LIMITED.

The Directors are prepared to receive written APPLICATIONS from duly qualified candidates for the APPOINTMENT of an ASSISTANT ARCHITECT on the Company's staff in India.

Candidates should be between the ages of 25 and 30 years and preferably unmarried. They must have served articles with an experienced architect in general practice, or have completed the full course at a recognised Architectural School, and have not less than four years' experience as an Architect's Assistant or Clerk of Works. They should also, if possible, have had experience of steel-frame buildings, or have a special aptitude for large-scale and full-size detail work.

The appointment will be for two years, and may be extended.

The starting salary of the successful candidate will be fixed according to qualifications with a maximum of Rupees 700 a month.

The incumbent will be entitled to the benefits of the Company's Provident Fund.

The Company will provide a first-class passage to India, and the salary will commence from the date of sailing.

Forms upon which applications must be made may be obtained from the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
24th June, 1925. 9584

South Staffordshire Waterworks COMPANY.

CIVIL ENGINEERING DEPARTMENT.

APPLICATIONS are INVITED from qualified persons for the APPOINTMENT of RESIDENT ENGINEER on the Construction of a Reinforced Concrete Reservoir of about seven million gallons capacity and contingent works at Dudley.

Applicants must be corporate members of the Institution of Civil Engineers, have had considerable experience in reinforced concrete construction, preferably in relation to waterworks, and be capable of carrying out the tests for cement as laid down in the latest British Standard Specification for Portland Cement.

A medical certificate of fitness will be required.

The salary will be at the rate of £450 per annum inclusive, and the duration of the appointment eighteen months to two years.

Applications, stating age and giving details of education, training and experience, accompanied by copies only of three recent testimonials, should be addressed and delivered to the undersigned not later than 6th July, 1925.

FRED. J. DIXON, M. Inst. C.E.,
Engineer-in-Chief.

Engineer's Office,
26a, Paradise-street, Birmingham,
14/6/1925. 9501

SITUATIONS OPEN

WANTED, ENGINEER.—Well-known Firm of Agricultural and General Engineers REQUIRES the SERVICES of a competent SALES ORGANISER, experienced in Steam Power Plant, for Home trade and abroad.—Address, 9580, The Engineer Office. 9580 A

WANTED, a YOUNG MAN, 30 to 35 Years of Age, to Assist in General Management of Large Birmingham Machine Tool Works. Must have had shop, drawing-office and commercial experience in the trade. Knowledge of French desirable. Good opportunity for suitable man. Give full particulars of experience, copies of testimonials, age, and salary.—Address, 9418, The Engineer Office. 9418 A

CONSTRUCTIONAL STEELWORK.—WANTED, ASSISTANT to CHIEF of Estimating, Designing and Drawing-office, capable of Taking Charge; good technical training and knowledge of values essential; Midland district. State age, qualifications, salary required.—Address, 9575, The Engineer Office. 9575 A

SITUATIONS OPEN (continued)

COSTING and ESTIMATING CLERK WANTED by Marine Engineers and Shipbuilders in Shanghai. Age about 35. Able to type and write shorthand. Must be total abstainer, single. Salary 300 Mexican dollars per month.—Address, detailing qualifications and experience, P753, The Engineer Office. P753 A

ENGINEER WANTED, with Full Experience of Elevating and Conveying Machinery, particularly Apparatus dealing with Boxes, Packages, &c.—Address, giving age, details of past experience and salary required, 9509, The Engineer Office. 9509 A

GENERAL ENGINEERS in London, Manufacturing Elevating and Conveying Machinery and other specialities, REQUIRE WORKS MANAGER. Must have experience designing, estimating, and possess organising ability.—Address, stating full particulars, past experience, salary required, 9591, The Engineer Office. 9591 A

GOOD OPENING for TECHNICAL MAN with practical knowledge of design and working of Boilers to promote sales. Good salary.—Apply, with full particulars, to COCHRAN and CO., ANNAN, Limited, Boilermakers, Annan. 9574 A

JUNIOR ENGINEER, Experienced in Modern Combustion Plant and its progress, REQUIRED as TECHNICAL and SALES REPRESENTATIVE in the East; public school, and/or University man preferred. State age, experience, salary expected.—Address, 9578, The Engineer Office. 9578 A

SHEFFIELD MANUFACTURERS of High-speed Steel and highest grades of Crucible Cast Steel REQUIRE the SERVICES of a REPRESENTATIVE for Birmingham and the Midlands. Considerable business is already done in the district. Good salary and commission await the successful applicant, who must be well known and possess good live connection. Applications treated in strictest confidence.—Write, D.W. 40, "Sheffield Telegraph," Sheffield 9562 A

STRUCTURAL ENGINEER REQUIRED for British Engineering Works in India, with wide experience in design, estimating, and manufacture of Bridge Work and all classes of Steel Structures. Applicants must have had a thorough theoretical and practical training, be fully conversant with modern works practice, and be competent to take a senior position. Age 34 to 40.—Address, stating age and giving full particulars of qualifications and previous experience, P773, The Engineer Office. P773 A

SUPERHEATERS.—CLERK WANTED, with Good general knowledge of trade. Duties primarily advertising and circularising. Preference given to disabled ex-Service man with necessary qualifications.—DEE SUPERHEATERS, Ltd., Bishtons Bridge, Netherton, Worcs. 9573 A

SUPERVISOR of CONSTRUCTIONAL STEEL WORK ERECTION REQUIRED by large firm in London, thoroughly conversant with modern methods of erection of Steel-framed Buildings. State age, experience, salary required, and when free. Only really capable men need apply.—Address, P751, The Engineer Office. P751 A

WANTED, DRAUGHTSMAN, by Well-known Firm of Milling Engineers.—Address, stating experience, &c., 9285, The Engineer Office. 9285 A

WANTED, JUNIOR DRAUGHTSMAN in London Engineers' Office. Experience in Tank Work preferred. State experience and salary required.—Address, 9536, The Engineer Office. 9536 A

DRAUGHTSMEN.—BEFORE NEGOTIATING with Government Departments in connection with any post, PLEASE COMMUNICATE with the GENERAL SECRETARY, Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's-square, London, S.W. 1. 8768 A

DRAUGHTSMEN, FIRST-CLASS.—DRAUGHTSMEN REQUIRED temporarily in Railway Engineer's Office in London for general constructional work.—Address, stating age, experience, and salary required, 9548, The Engineer Office. 9548 A

EXPERIENCED ROLLING STOCK DRAUGHTSMAN REQUIRED in North of England; must be fully conversant with all classes of Steel and Wood Wagons.—Address, stating age, experience, wages required, and when at liberty, P767, The Engineer Office. P767 A

GOOD DRAUGHTSMAN WANTED for Constructional Engineers' Office in London. Must be thoroughly capable and used to preparing Shop Drawings from small scale plans.—Address, stating age, experience, salary required, and when free for engagement, P755, The Engineer Office. P755 A

HEATING DRAUGHTSMAN REQUIRED; Must be fully experienced, capable of scheming and estimating for large contracts.—State age, experience, and salary required to THE BRIGHTSIDE FOUNDRY and ENGINEERING CO., Ltd., 17, Summer-row, Birmingham. 9546 A

JIG and TOOL DRAUGHTSMAN (Experienced) REQUIRED for Motor Work (London).—Address, with full particulars and salary required, 9544, The Engineer Office. 9544 A

LOCOMOTIVE DRAUGHTSMEN.—The NORTH BRITISH LOCOMOTIVE CO., Ltd., Springburn, Glasgow, REQUIRE the SERVICES of TWO capable MEN with good technical training.—Address, "CHIEF DRAUGHTSMAN," giving full particulars of experience, &c. P757 A

REQUIRED, a First-class BRIDGE and STRUCTURAL ENGINEERING DRAUGHTSMAN for a Municipal Engineer's Office in the North of England. State full particulars, experience and salary required.—Address, 9504, The Engineer Office. 9504 A

STRUCTURAL DRAUGHTSMEN REQUIRED for important Constructional Engineers in Manchester District. Must be first-class men, well up in the design and detailing of Steel-framed Buildings. Good salaries paid to the right men; no others need apply.—Address, stating age, experience, and salary required, 9519, The Engineer Office. 9519 A

POWER-HOUSE WORKING FOREMAN WANTED, for 800 K.W. Traction Generating Station with horizontal slow-speed engines and Lancashire boilers. Wages £4 per week.—Address, stating age, experience, and earliest date when duties could be commenced, 9571, The Engineer Office. 9571 A

REQUIRED by a European Firm of Structural and General Engineers in India, as ASSISTANT FOREMAN in their Structural Department. Applicants must have experience in Template Making and be accustomed to Bridge, Roof and General Structural Work. Must be a bachelor and not more than 26 years of age.—Apply, stating age and full particulars of experience, to Z. T. 854, c/o Deacon's Advertising Agency, 9, Fenchurch-avenue, London, E.C. 3. 9543 A

SITUATIONS WANTED

ADVERTISER (37), Well Educated, Thoroughly experienced chief engineer in steam and Diesel engined vessels (2 and 4-cycle engines), 1st Class B.O.T. Certificate, M.I.E.S., drawing-office experience, WISHES responsible POSITION. Smart, keen, energetic. Excellent references.—Address, "ENGINEER," Wm. Porteous and Co., Glasgow. P760 B

A.M.I.C.E. (34), Thorough Works and D.O. Train-ing, locomotive, mechanical, steam, general and maintenance; speciality, control of staff and economy, some commercial experience, DESIRES progressive POST. Moderate salary.—Address, P768, The Engineer Office. P768 B

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

The Position of British Commerce.

THE relative prosperity of the electrical branch of the engineering industry continues to be emphasised from week to week. This week we have to record that the General Electric Company has issued a very satisfactory report regarding its operations during the year ended March 31st, 1925. The works, it is stated, were fully employed during the period and the volume of orders received was satisfactory. The profits amounted to £1,029,983, as compared with £835,561 in the preceding year and £751,486 two years ago. The prosperity thus revealed is made all the more remarkable by comparison with the state of affairs disclosed in the reports of two other well-known engineering firms published this week. Sir William Arrol and Co., Ltd., record a debit balance during 1924 of £160,047. In 1923 a debit balance of about half this amount was recorded. Turning from bridge building and constructional engineering to shipbuilding and steel making, we find that William Beardmore and Co., Ltd., report a net loss for 1924 of £503,094 after allowing for all charges. This figure compares with a loss of £68,071 in 1923 and a profit of £96,167 in 1922. These figures help us to realise the significance of a statement regarding our national commercial and industrial position which has been made by Sir Allan Smith, of the Engineering and Allied Employers' National Federation. Sir Allan states that our trade balance, that is, our income available for investment abroad, fell from £252,000,000 in 1920 to £29,000,000 in 1924, and that, as estimated from the results of the first five months, 1925 will show an adverse balance of £26,000,000. Apart from the war years this country has not previously had to experience the meaning of an adverse trade balance. In Sir Allan's opinion it must in time mean national bankruptcy.

The Proposed Mersey Tunnel.

GIVING evidence on behalf of the promoters before the House of Lords Select Committee which is inquiring into the scheme for the proposed tunnel under the Mersey between Liverpool and Birkenhead, Mr. Basil Mott, principal engineer engaged on the scheme, described on Monday some of the details of the work. Particulars of the tunnel as first proposed were published in our issue of October 5th, 1923, but since that date certain of the local authorities have decided not to support the scheme and others have objected to some of its features, with the result that the plan has been considerably modified. The branch tunnel to Wallasey has been abandoned because of the decision of that borough to dissociate itself from the scheme. In the lower part of the tunnel it was originally intended to have a double line of tram rails, the upper half being devoted to vehicular and foot traffic. Birkenhead has, however, objected to tramways passing through the tunnel on the ground that they would be in a position to compete with the town's passenger ferries. This feature of the scheme has therefore been dropped, for if Birkenhead had not been placated Liverpool alone would have been left in support of the scheme. We gather, however, from Mr. Mott's evidence that, although tramways are not to be run through the tunnel, the original size, namely, 44ft. in diameter, will be adhered to in order to provide accommodation for a future expansion of traffic. The various modifications indicated by Mr. Mott are expected to reduce the cost of the work from about £6,500,000, the original estimate, to about £5,000,000. It was objected during the course of the inquiry that the tunnel would be unnecessarily large and expensive for its now restricted duties, but the chairman of the Select Committee, the Earl of Wemyss, stated that the Committee would not be greatly influenced by any questions as to the size of the tunnel, for it held that if a tunnel were to be made it should be of sufficient dimensions to cover future needs.

German Shipbuilders' Difficulties.

WHEN the Furness-Withy group placed an order last March for five motor ships with the Deutsche-Werft shipbuilding works, of Hamburg, there was a considerable outcry as to the unpatriotic action of the group and as to the relative inefficiency of British shipyards which the loss of the order seemed to imply. The first criticism was largely silenced when it was learned that the German quotation was £60,000 per ship lower than the lowest British tender. Criticism of the second category is not yet silenced, but it is likely to be reduced by the information published by our contemporary, the *Financial Times*, that the Deutsche Werft report for 1924 reveals a deficit of 1,205,823 marks, or very nearly a quarter of its share capital. It is suggested that the company's financial position is not such as to encourage it to continue its unproductive cut-throat competition. Another German shipbuilding company, the Reiherstieg Shipbuilding and Machinery Company, of Hamburg, employing over 2000 workpeople, is also stated by our contemporary to be in difficulties. This company is allied with the Benz engine works and the Phœnix Iron and Steel Company, from which it obtains respectively its marine oil engines and its steel material. The absence of new business and an insufficiency of funds led the company into difficulties from which various schemes have not yet extracted it. It is now turning for the second time to the German Government for financial assistance.

Burdens on Industry.

AT the annual general meeting on Monday of Ruston and Hornsby, Ltd., of Lincoln, the chairman, Mr. J. S. Ruston, revealed an example of how heavily the burden of taxation and contributions towards social service can weigh on a large engineering establishment at the present moment. The firm's annual contributions to unemployment and health insurance amount to £25,000. If the proposed pension scheme now before Parliament becomes law a further £6000 will be added under this head. The poor and district rates paid by the firm make up a grand total of £60,000 per year, or £1200 per week, which the company has to find whether it makes a profit or not. It is worth adding that after meeting all charges the sum left over available for distribution among the firm's ordinary and preference shareholders, as a result of the past year's trading, was £69,886. Thus for every shilling that might be drawn from the business for the benefit of the shareholders, the external charges, quite apart from income tax, drain away 10d. In actual fact, the ordinary shareholders are to get nothing, while the preference holders are to be paid the dividends which they have had to do without during the past two years.

The Electrification of the Penge Tunnel.

ON Monday, June 22nd, the first electric train passed through the Penge Tunnel on the Southern Railway, and until July 12th, the day of opening of the electrified system, three trains will be run through the tunnel each day for test purposes. For the supply of direct current to the line within the tunnel it was necessary to sink a shaft from a sub-station on the Crystal Palace branch of the railway into the tunnel, to a depth of 130ft. The work of constructing this shaft, which is 6ft. in diameter, was complicated by the fact that steam trains were running in the tunnel at the time the boring operations were being carried out. At the end of six weeks, however, the bottom of the shaft was reached, and it was found that it was barely a quarter of an inch away from the spot which the engineers intended to strike. The Penge Tunnel under steam-train conditions is a most uncomfortable and gloomy place for all who have to pass through it. It is a mile and a quarter long, and was opened in July, 1863.

A Japanese Naval Programme.

ACCORDING to recent advices from Tokyo, the current Japanese Navy Law is to be modified by the addition of fourteen vessels, which are to be completed before the end of 1929. Four of these ships will be cruisers of the 10,000-ton class, four destroyers of 1500 tons each, and the remaining six submarines of a tonnage not specified. The laying down of these new vessels is officially justified on the ground that other Powers are proceeding energetically with the reinforcement of their naval armaments. The latest Admiralty Return of Fleets showed Japan to have under construction on February 1st, 1925, three cruisers of 5570 tons, four of 7100 tons, and two of 10,000 tons, with two more of the last-named type projected. If the impending programme is adopted the number of 10,000-ton cruisers building and projected will be increased to eight. The new destroyers, the construction of four of which is intended, will be heavier by 100 tons than those already completed or on the stocks. It is probable that all the six additional submarines will be of the large, oceanic class, of 1500 tons or more, which Japan has developed in the last few years. In the official return, mentioned above, the main armament of the Japanese 10,000-ton cruisers already under construction is tentatively given as twelve 8in. guns. We have reason to believe, however, that the actual armament of these ships will consist of nine 8in. guns in triple turrets.

The International Railway Congress.

THE tenth session of the International Railway Congress was formally opened on Monday, when the chair was taken, in the absence of the Prince of Wales, the President, by the Duke of York. The chairman's address was followed by a speech by M. Foulon, the President of the Permanent Commission, who reminded his hearers that the present meeting was the fortieth anniversary of the establishment of the Congress, which itself arose out of the celebrations of the jubilee of the Belgian railway system. Colonel Wilfrid Ashley, Minister of Transport, on behalf of the Government, welcomed the delegates, and then, in a few exceedingly happy words, Viscount Churchill did the same on behalf of the British railways. Lord Churchill subsequently was elected acting chairman of the Congress, and M. P. L. N. Ghilain and Sir Henry Fowler were appointed the general secretaries. Allusion was made to the presence, in his eighty-third year, of M. E. Holemans, who has been the treasurer of the Association since its inauguration forty years ago, and of Mr. Gustav Behrens, who attended the London session of 1895 as a delegate from the Midland Railway, and was present on Monday as a Vice-president of the Permanent Commission, and as a director of the London, Midland and Scottish Railway.

French Trade Policy.

THE policy which was inaugurated in France soon after the Armistice of rendering the country as far as possible self-supporting by developing the nation's manufacturing industries under the protection of high import tariffs and of procuring most of the raw material from the Colonies, has created new difficulties of a wholly unexpected character. The French production has enormously increased, and with the restoration of Alsace-Lorraine and the temporary accession of the Saar basin, France is obliged to look to foreign markets for the disposal of her ever-growing surplus. The protectionist policy so far pursued has had the effect of provoking retaliation from other countries, and foreign markets are being closed, not only to purely French products, but also to the products of Alsace-Lorraine, which can no longer find their way into Germany. France has become a great exporting country. A sound commercial policy is therefore of more importance than industrial protection, and for some months past there have been indications of a growing movement in favour of facilitating an interchange of goods with other countries. The question is indeed closely associated with the political negotiations now taking place. Judging from the propaganda work being carried out in France, supported by the efforts of British trade officials, it would appear that when peace is definitely assured by the operation of the guarantee pact, the French Government will endeavour, with foreign aid, to put the national finances in order, settle the problem of inter-allied debts, and enter into a system of commercial treaties which will facilitate foreign trade.

Noises from Electric Light Wires.

IN houses wired for electric light and heating it is quite possible for very irritating noises to be produced in the headphones of wireless receivers, especially in the case of 100-cycle supplies, which exist in certain towns. There are various ways of wiring houses, and it would appear that in the case of wiring systems in which metal sheathed wires are used, the trouble would be less pronounced than it is in houses in which ordinary rubber-covered wires are employed. In order to settle this point, however, Mr. Percy Dunsheath has carried out some tests in the research laboratories of W. T. Henley's Telegraph Works Company, Ltd. About 50 yards of metal-cased twin cable and a similar length of ordinary twin insulated cable were laid in the laboratory and connected to two sides of a two-way switch, which enabled one or the other of the cables to be made "alive." Headphones of a crystal set placed within a few feet of the metal-cased cable were in no way affected by the alternating current; but when the unprotected rubber cable was energised a perceptible hum was produced. On connecting a three-valve amplifier and loud speaker to the output terminals of the crystal set, the induction from the rubber-covered cable produced a loud note, but on switching over to the metal-cased cable only a very faint note could be detected.

Scientific Research at the Air Ministry.

THE Air Ministry announces that Sir Samuel Hoare has appointed Mr. H. E. Wimperis to be Director of Scientific Research, and Mr. D. R. Pye to be Deputy-director of Scientific Research. The functions of scientific research and technical development at the Air Ministry were formerly combined in one directorate, but they have now been divided between two directorates, both of which, however, come under the supervision of the Air Member for Supply and Research. Mr. Wimperis has been acting provisionally for some time as Director of Scientific Research. Following his training at the Imperial College of Science and Caius College, Cambridge, and after several years' experience with important engineering organisations, he joined the engineering staff of the Crown Agents for the Colonies. On the outbreak of war, he began his intimate association with aeronautics, undertaking experimental work, both for the Royal Naval Air Service and the Royal Flying Corps, particularly with regard to navigational and armament devices. On its inception in 1915, he became head of the Royal Naval Air Service—now the Air Ministry—Laboratory at the Imperial College of Science, and has held that position continuously since. Mr. Wimperis is the inventor of a number of devices relating to road and air transport, some of which, such as the drift and course-setting sights, have been adopted as part of the standard equipment of the Royal Air Force and have been described in our columns. Mr. D. R. Pye is at present Lecturer in Engineering at Trinity College, Cambridge. Following his training at Tonbridge School and Trinity College, Cambridge, Mr. Pye became chief assistant to Professor Jenkin, who was in charge of engineering studies at Oxford University. During the war he joined the Royal Flying Corps, and was posted as an experimental officer, subsequently becoming a qualified pilot. Later he served at the Air Ministry, acting as scientific assistant in the Technical Department.

The British Steam Railway Locomotive from 1825 to 1924.

By E. L. AHRONS, M.I. Mech. E.

No. XXVI.*

PERIOD 1870 TO 1875 (*continued*).

COUPLED EXPRESS ENGINES, 2–4–0 TYPE (*continued*).

F. W. WEBB's 2–4–0 express engines on the London and North-Western Railway were a complete contrast in nearly all respects to the types described above. The Crewe engines of 1874 to 1882, until the appearance of the three-cylinder compound engines, were small and light. Low cost seems to have been the main principle aimed at in designing an engine with a maximum of tractive force for a minimum weight, an excellent principle provided that the tractive power is real and not nominal. The two classes of engine described below provide a very interesting study of the effect of locomotive proportions.

The first of these, the "Precursor" class[1]—Fig. 201—appeared in April, 1874, and for the purpose of

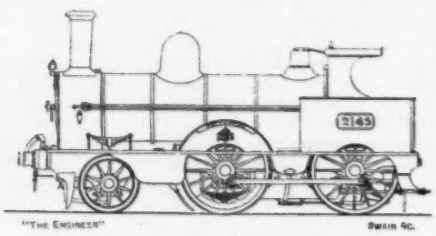


FIG. 201—WEBB'S "PRECURSOR," 1874

working over the Crewe–Carlisle section, on parts of which the gradients are heavy, had coupled wheels only 5ft. 6in. dia. Before deciding upon this dimension, Mr. Webb for a time tried a six-coupled goods engine with 5ft. 6in. wheels on fast trains, by removing the coupling rods between the leading and driving wheels, with apparently satisfactory results.

The "Precedent" class—Fig. 202—which came out in December, 1874, was originally intended only for the heavier trains on the southern division between Crewe and Euston, a line which has comparatively easy gradients, though the trains were heavier. Apart from the size of the coupled wheels, 6ft. 7½in., in the case of the "Precedents," the only other differences of moment between the two classes were that the latter had somewhat larger fire-boxes, giving 103 square feet of heating surface, as compared with 94.6 square feet of the "Precursors," the boiler of the "Precedent" was pitched with its centre further from the rails, and the latter engines weighed 27 cwt. more.

The following dimensions and particulars were common to both classes:—Cylinders, 17in. by 24in.; ports, 14in. by 1½in./3½in.; centres of cylinders, 2ft., a dimension which enabled long bearings to be given to the crank axle, and which was attained by making the steam chest of ▽ form. The cylinders were horizontal, but the port faces were inclined laterally and also longitudinally to suit the inclination of the valve spindles, an arrangement which allowed plenty of space in the steam chest. The leading wheels were only 3ft. 7½in. diameter, the axle-boxes having ¼in. lateral play, controlled by inclined planes. These axle-boxes were of gun-metal, but those of the coupled wheels were of cast iron and of the American pattern with crescent-shaped brasses forced into place. All hornblocks were of cast iron. Main frames, ¾in. thick; bearings of coupled axles, 7in. diameter by 9in. long; wheel base, 7ft. 5in. + 8ft. 3in. = 15ft. 8in. Allan's straight link valve motion was used.

The boiler, in three rings, had a diameter of 4ft. 0¼in. inside the front ring and 4ft. 2in. inside the back ring, and contained 198 1¾in. tubes, the heating surface of which was 980 square feet. Total heating surface of "Precursor," 1074.6 square feet, and of "Precedent" 1083 square feet; grate area, 17.1 square feet, and pressure 140 lb. in both engines. The fire-box of the "Precursor," as built, had a longitudinal narrow brick arch which extended from the main arch to the back plate, and acted as a deflector. This was afterwards abandoned. The fire-hole rings were of gun-metal protected internally by a steel lining. The regulator was in the smoke-box, and resembled a rotating Corliss valve. Subsequently, Mr. Webb discarded this regulator and returned to Ramsbottom's double-beat type placed in the dome.

A feature common to all the L. and N.W.R. engines was an ash hopper beneath the smoke-box, into which the ashes descended through spaces at the sides of the cylinders. The hopper tapered to an opening at the bottom, 5½in. by 1½in., and to prevent the air from rushing up it the back plate was made shorter than the front plate. It was stated that this apparatus did not seriously affect the draught of the engine, and since it was used for many years, no great trouble seems to have arisen from it.

The blast orifice of the Precursor was originally 4¾in., but the writer is under the impression that it was subsequently reduced to that of the Precedent, viz., 4½in. diameter.

Another slight difference in detail between the two engines may be noted. The "Precursors," having small driving wheels, were made with the half-throws of the coupling rods 10in. only. In this respect Webb copied Stroudley's practice, but the latter used the short throw for 6ft. 6in. coupled engines also, whereas in Webb's 6ft. 7½in. "Precedents" the throw was longer, though whether it was 11in. or 12in., the writer is uncertain. A peculiarity of an extremely dubious nature in the Precursor was that, although there were balance weights in the rims of the driving wheels, there were none in the trailing wheels, and presumably the revolving masses in the latter were unbalanced. The official weights in working order were:—

	Precursor. t. c.	Precedent. t. c.
Leading	10 8	10 5
Driving	10 10	11 10
Trailing	10 10	11 0
	31 8	32 15

These weights may be compared with the 36¾ to 39¼ tons weight of the corresponding Midland and North-Eastern engines of that day, with 17in. by 24in. cylinders. The difference lay chiefly in the boilers and frames. As regards boilers, those of the L. and N.W.R. engines appear too small for heavy main-line express work. They may have been just large enough for the work required in 1874-6, but subsequently they had to be forced at the cost of heavy fuel consumption. In 1874 the Midland increased the sizes of the boilers and fire-boxes for 17in. by 24in. cylinders, making the heating surface 1225 square feet, instead of about 1120 square feet, and that of the N.E.R. and G.W.R. engines also exceeded 1200 square feet. The maximum cut-off in full gear in both "Precursors" and "Precedents" was then only about 63¼ per cent. of the stroke, as compared with 70 to 72 per cent. then usual on other railways.

On the other hand, there were several good features in the design, notably the long bearings, ample-sized crank webs, and the large ports. The area of each of the steam ports, 21 square inches, was .0925 of the piston area, and the undoubtedly excellent speeds which the "Precedents" frequently attained was probably due to the ease with which the exhaust steam left the cylinders.

These engines have been described at some length for reasons which will appear below. Of the "Precedents" it may be said that they were the mainstay of the L. and N.W.R. express services for about thirty years. The three-cylinder compounds succeeded them between 1883 and 1898, but the latter were not always reliable, and whenever any steady hard main line work had to be done in emergencies the "Precedents," undersized though they were, had to do it somehow, though their coal bill was high. After 1887 the pressure of the "Precedents" was raised to 150 lb. when new boilers were provided.

To appreciate the results given by the "Precursors," which have considerable interest, a few particulars of gradients and train speeds are necessary. The engines worked through between Crewe and Carlisle (141¼ miles) on some turns; on others between Preston and Carlisle (90 miles), or Preston and Crewe (51¼ miles). From Crewe to Preston and thence to a point about 34 miles north of the latter station the gradients are generally easy, and the two or three short sharp rises of 1 in 100 to 1 in 132, each about one mile long, can be "rushed" by a train running at speed. The heavy work then begins with the 13-mile ascent, averaging 1 in 125 to Grayrigg, the last two miles being at 1 in 100. From Grayrigg there is a fall of about 5 miles to near Tebay, giving a fast train the opportunity of running at the Shap bank, which starts with 2 miles of 1 in 147, followed by 4 miles of 1 in 75. The last 31 miles to Carlisle from the summit are downhill, the steepest gradients being at 1 in 125 (6¼ miles) and 1 in 132 (3 miles). Summing up, of the 141¼ miles there are only about 20 miles on the down journey of really hard uphill gradients, the rest of the road being comparatively level or downhill. On the up journey from Carlisle the work is harder with about 33 miles of "collar work," of which nearly all has to be done in the first 31 miles from the dead start at Carlisle.

The fastest train was the 10 a.m. Scotch express

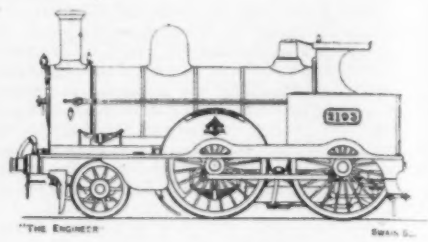


FIG. 202—WEBB'S "CHARLES DICKENS," 1882

from London, which was booked at a speed of about 46 miles per hour from Crewe to the first stop at Preston. From Preston to Carlisle the time allowed was 2 h. 10 min., a speed of 41¼ m.p.h. The night Scotch express ran from Crewe to Wigan, 36¼ miles, at the rate of 45 m.p.h.; Wigan to Preston, 15 miles, at 42.8 m.p.h.; Preston to Carnforth, 27¼ miles, at 42 m.p.h.; and from Carnforth to Carlisle, 62¼ miles, at just over 40 m.p.h. There were corresponding up trains, and a number of additional expresses at slightly slower speeds. The loads of the trains varied from eleven to fifteen six-wheeled coaches, the fastest trains having about eleven or twelve. If their weight be taken at about 11 tons each, an approximate idea of the total weights may be obtained. Trains of eleven, or occasionally twelve, coaches ascended the Shap bank unaided, as they were helped by the preceding downhill run. With greater loads a pilot engine was taken, usually in the form of a bank engine at the rear from Tebay, where a special stop was made for the purpose. From Carlisle to Shap summit on the up journey pilot engines were very frequently used.

The "Precursors" were specially built with small driving wheels to negotiate these gradients, and there is no doubt that with a tractive force of 105.1 lb. per pound of mean pressure they climbed the hills better than Ramsbottom's 6ft. 6in. coupled engines which preceded them, but the latter had only 120 lb. boiler pressure, as against 140 lb. of the "Precursors." But after about three to four years' work the "Precursors" had to be taken off the fastest trains, on which they were replaced by the 6ft. 7½in. coupled "Precedents." For some years longer the "Precursors" worked the slow and semi-fast trains only, and for about twenty years they also worked the slower trains between Manchester and Leeds, a road with heavy gradients. They failed in working the fast trains over the Carlisle road owing to the higher speeds which were necessary on the easy portions between Crewe and Carnforth and the downhill running on both sides of Shap summit. Their hill-climbing ability, tempered though it was by the small size of their boilers, could be utilised only over a comparatively short portion of the total mileage, and for the remainder of the journey the driving wheels were too small for economical and satisfactory work.

The principal dimensions of these engines may be compared with the Schenectady engine, with which Dr. Goss conducted his experiments at Purdue, U.S.A. The cylinders, 17in. by 24in., and the boiler pressure, 140 lb., were the same in both cases. The steam port

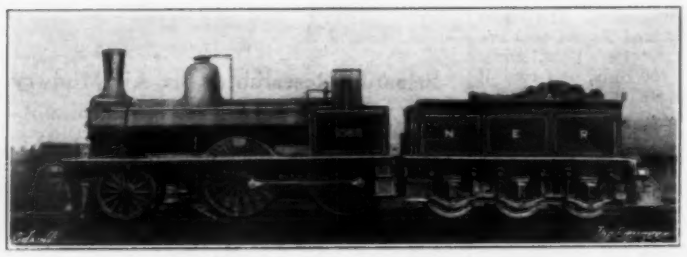


FIG. 203—N.E. (S. AND D.) LOCOMOTIVE, 1875-8

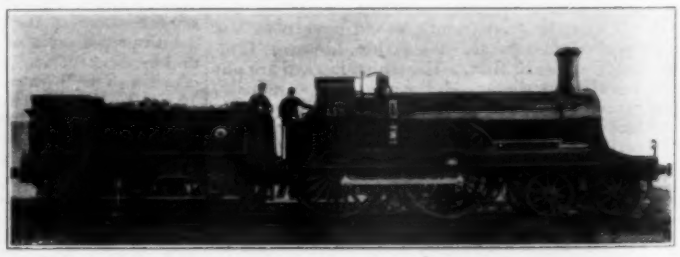


FIG. 204—G. AND S.W. LOCOMOTIVE, 1873-7

* No. XXV. appeared June 19th.

[1] These engines must not be confused with the present "Precursor" class, designed by Mr. Whale in 1904. Unfortunately both classes were always known by the name of the first engine of each.

area of the "Precursor" was slightly larger, in the ratio of 21 to 20, but the Schenectady engine had a larger boiler. The driving wheels of the latter were 5ft. 3in., *i.e.* 3in. smaller. Dr. Goss found that the "critical speed," *i.e.*, the speed at which the power and efficiency of a locomotive are a maximum, was not far from 200 revolutions per minute, corresponding to a piston speed of 800ft. per minute for 24in. stroke. Professor Dalby ("Proc.," Inst. C.E., 1906) worked out one series of Goss's experiments, and found that with a cut-off of 25 per cent. and boiler pressure 130 lb. it showed a maximum indicated horse-power piston speed of 887ft. per minute with a mean pressure in the cylinders of 27.5 lb. per square inch. The data for the Precursor can only be assumed approximately, but it will probably not be far from the mark if we take the maximum horse-power piston speed to be 880ft. per minute, and for 140 lb. boiler pressure and 25 per cent. cut-off, the M.E.P. works out at about 32.5 lb. per square inch, using Professor Dalby's method. This corresponds to a speed of 43.2 miles per hour for the Precursor, as that at which the maximum indicated horse-power, about 393, was obtained. As the trains were timed so that long distances had to be run at speeds of 50 to 60 miles per hour in order to keep time, it is apparent why the "Precursors" were not satisfactory, though it must not be forgotten that the knowledge derived from Goss's experiments was not available when the engines were designed. At 55 miles per hour the Precursor would develop about 362 indicated horse-power with a M.E.P. of 23.5 lb., and at 60 miles per hour the indicated horse-power would drop to about 336, supposing the cut-off to remain unchanged at 25 per cent. and the boiler could supply the steam.

The cylinders and ports of the "Precedent" class with larger—6ft. 7in.—wheels were exactly similar to those of the Precursor, and if similar valve setting also be assumed, it seems reasonable to take it that the maximum high-pressure piston speed at 25 per cent. cut-off may also be taken at 880ft. per minute. This corresponds to 51.6 miles per hour. Using the sure mean pressure line, the indicated horse-power curves show that up to about 46 to 47 miles per hour the Precursor developed a greater indicated horse-power than the Precedent, but beyond that speed the Precedent was the more powerful engine, although its tractive force per pound of mean effective pressure was only 87.8 lb., as against 105.1 lb. for the Precursor. The above figures take no account of the internal frictional resistances of the engines. At equal speeds in miles per hour the Precursor would lose more power in friction than the Precedent owing to the higher piston speed. The result, though paradoxical, is borne out by the performances of the two classes of engine. The factor of adhesion of the two engines was in the ratio of 1.25 to 1 in favour of the Precedent. When now the Precursor was said to have developed 529 and 531 indicated horse-power at 49 and 58 miles per hour, the respective piston speeds being 998½ft. and 1181½ft. per minute. The boiler pressures were 126 lb. and 123 lb., and the mean effective pressures 38.6 lb. and 32.7 lb. respectively.[2] Had the engines been able to produce these results consistently and economically, they would hardly have had to be taken off the expresses and replaced by the "Precedents."

Brief mention may be made of the "Charles Dickens," the most celebrated of the "Precedent" class. Built in February, 1882, it ran daily from Manchester to Euston and back, and in 1902 was stated to have completed 2 million miles on this service, after which it was relegated to lighter work. As it was broken up in 1912 the total mileage must have been about 2¼ millions. It would be interesting to learn how much of the original engine remained in it at the termination of its career. The other Precedents of 1874–1882 had been practically completely renewed, and very little, if anything, of the original engines remained. The crucial question is whether the original frames of the "Charles Dickens" lasted throughout, bearing in mind that they were only ⅞in. thick. Much may be done with a knife, if it be provided with three or four new blades, and a similar number of new handles.

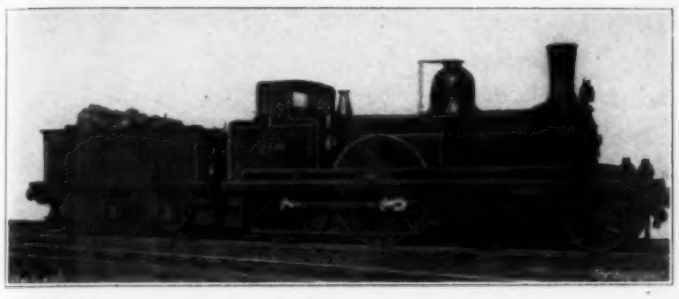


FIG. 205 N.E. (S. AND D.) LOCOMOTIVE, 1872-4

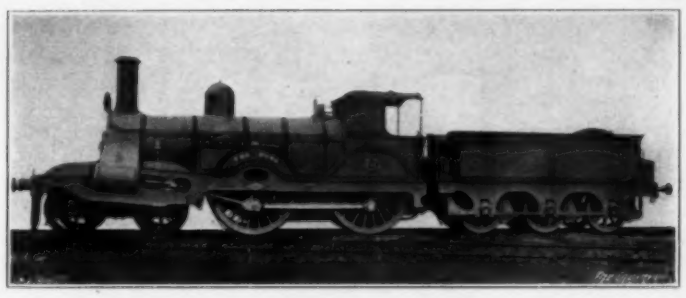


FIG. 206 HIGHLAND LOCOMOTIVE, 1874

The 2–4–0 engine—Fig. 203—built at the North Road Engine Works, Darlington, in 1875, is of considerable interest in that it represents the last type of passenger engine of "Stockton and Darlington" design. It was due to Mr. John Kitching, then in charge of Darlington works. The engine, No. 1068, of the N.E.R., was shown at the Darlington Jubilee of 1875. All the springs of both engine and tender were underhung. The cylinders were 17in. by 26in.; diameter of coupled wheels, 6ft. 0½in., and of leading wheels of No. 1068, 4ft. 0½in., though later and very similar engines of 1876 had 4ft. 8½in. leading wheels. Wheel base, 8ft. 6in. + 8ft. The boiler, 4ft. diameter, had 158 2in. tubes, and a total heating surface of 1100 square feet; pressure, 140 lb.; the total weight was 31 tons 8 cwt. in working order, of which 20 tons 8 cwt. rested on the coupled wheels. Very similar engines, but with 6ft. 6in. coupled wheels, were built at Darlington in 1877.

4–4–0 *Express Engines.*—From 1871 onwards there was a gradual development of the 4–4–0 engine on British railways, chiefly in Scotland. The first two 4–4–0 engines of what is now the standard British type, *i.e.*, with inside cylinders and inside frames, were built by the North British Railway at Cowlairs Works in 1871 to the designs of Thomas Wheatley. They had 17in. by 24in. cylinders and 6ft. 6in. coupled wheels. The bogie wheels, 2ft. 9in. diameter, had solid centres; coupled wheel base, 7ft. 7in.; bogie base, 6ft.; weight in working order, 37 tons 1 cwt., of which 13 tons 17 cwt. rested on the bogie wheels.

Four similar engines, with larger 3ft. 4in. bogie wheels also with solid centres, and with boilers having domes on the middle of the barrel, were built in 1873, and were employed on the Edinburgh–Carlisle service. The first of the two 1871 engines, No. 224, was the one which went down with the Tay Bridge in the disaster of December ,1879. It was subsequently recovered, only slightly damaged, and put to work again.

The 4–4–0 engine, with *inside* cylinders, defined above as the British type, had been previously built in America.

The much larger and more modern engines designed by James Stirling for the Glasgow and South-Western Railway—shown in Fig. 204—presented several features of interest. The cylinders, 18in. by 26in., at 2ft. 4½in. centres, had large ports 16in. × 1¼in. and 3in.; diameter of coupled wheels, 7ft. 1in.; of bogie wheels. 3ft. 7in.; total wheel base, 20ft. 3½in.; coupled wheel base, 8ft. 3in. The bogie of the rigid centre pin type was peculiar in that the wheel base, 4ft. 10in., was extremely short, and the pivot was not central. Unlike his brother, Patrick Stirling, who in his 8ft. single engines placed the pivot behind the centre line, James Stirling placed it 1in. in front, dividing the base into 2ft. 4in. + 2ft. 6in. P. Stirling gave definite reasons for his arrangement, but it is not known that James Stirling ever announced his reason for adopting the opposite course. To damp lateral rocking on the bogie, two brackets were fixed on the frames, one on each side, with corresponding brackets on the main frames, and rubber washers between them. The main frames were 1¼in. thick.

The boiler was of the domeless type with perforated steam pipe, the regulator being placed in the smoke-box. The arched crown of the fire-box was stayed directly to the casing. The injector feed entered the boiler at the middle of the back plate of the casing underneath the firehole. J. Sirling at that time stated that no harm had resulted from this method, whereas when the water was delivered at the sides of the fire-box, injury to the latter occurred. The latter method was that used by P. Stirling in the early Great Northern 8ft. singles, though it was subsequently discarded for the usual method of feeding into the sides of the boiler barrel. J. Stirling in later years abandoned the feed inlet at the back of the fire-box for one through the smoke-box tube-plate.

The boilers of the G. and S.W.R. 4–4–0 engines contained 252 1¾in. tubes, which gave a heating surface of 1027.6 square feet. The total heating surface was 1111.8 square feet, and the grate area 16 square feet; pressure, 140 lb.; weight of engine in working order, 39 tons, of which the bogie carried 12 tons 12 cwt.

The first of these engines came out in July, 1873,

FIG. 207—L.B. AND S.C. TANK ENGINE, 1873-1887

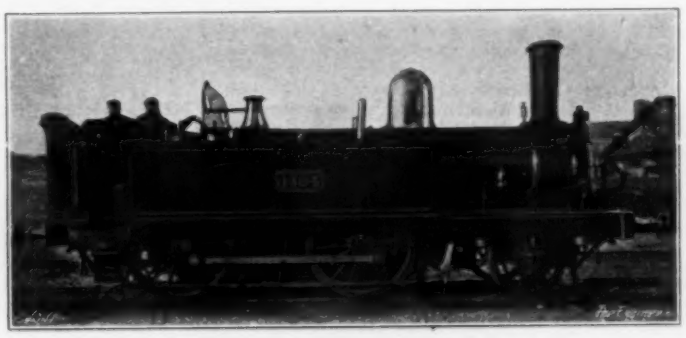


FIG. 208—G.W. TANK ENGINE, 1874-1878

from Kilmarnock works, and had lever reversing gear, but the succeeding 21 engines of 1874–7 were provided with steam reversing gear. This gear with steam and cataract cylinders placed horizontally on the driver's side in the cab is so well known that detailed description is unnecessary. It was the parent of nearly all modern forms of steam reversing gear. Its one disadvantage was that the engine could not be reversed at the running shed when not in steam. When putting the engine away at the shed it was left by the driver in mid-gear with the handles locked. The weigh-bar shaft was balanced by means of a coiled spring.

P. Stirling on the G.N.R. never adopted his brother's reversing gear, but stuck faithfully to the old lever and notched quadrant until his death in 1895. Although they were in agreement as regards boiler design, the brothers differed materially in their types of express engine. P. Stirling never built a 4–4–0 engine of any class; after 1873 J. Stirling never constructed any other type for main line passenger service.

In 1874 two 4–4–0 engines with inside cylinders 17in. by 24in. and four-coupled wheels 6ft. 7in.

[2] The indicator diagrams and drawings of the "Precursor" class appeared in *Engineering*, March 5th, 1875.

diameter were completed at Stratford Works for the Great Eastern Railway, to designs prepared by S. W. Johnson before he left that railway for the Midland. The drawings were made in 1872–3, and were contemporaneous with those of J. Stirling's engines. They were the first 4–4–0 engines with inside cylinders and inside frames to be placed in service on any *English* railway. The bogies, which had 3ft. 7in. wheels and a base of 6ft., were of Adams's sliding type. The total heating surface was 1210½ square feet, and the pressure 140 lb. An interesting detail was that the fire-boxes were of iron, but after about two years' service were replaced by copper boxes.

Of the 4–4–0 type with outside cylinders, ten remarkable engines—Fig. 205—were designed by W. Bouch and built at the Darlington works of the Stockton and Darlington section of the N.E.R. Although they had wheels 7ft. diameter, they were not express engines as ordinarily understood, since the S. and D. main line retained for the purpose of securing the cylinders between it and the inside frame. The cylinders were 18in. by 24in., inclined at 1 in 12; diameter of coupled wheels, 6ft. 3in., and of bogie wheels, 3ft. 9½in.; wheel base, 6ft. + 6ft. 9in. + 8ft. 9in. = 21ft. 6in.; heating surface of tubes, 1132 square feet; of fire-box, 96 square feet; total, 1228 square feet; grate area, 16¼ square feet; pressure, 140 lb.; the weight in working order was 41 tons, of which 14½ tons were carried by the bogie.

The frames were of wrought iron with hornblocks of cast steel. The fire-box was stayed by three girders on each side and two rows of direct roof stays in the middle. The steam chests were cast separately from the cylinders, and the vertical slide valves of cast iron had flanges with rubbing strips to support them at the bottom. The valve gear was Allan's straight link. The connecting and coupling-rods were of best Yorkshire iron, the ends being case-hardened, no bushes being used for the coupling-rods. The chimneys of all D. Jones's Highland engines were double, and the outer casing was provided with louvres in front to increase the draught when the engine was running fast with an early cut-off. The neat and roomy cabs, with rounded corners, deserve notice. They were derived from the cabs introduced a few years earlier by W. Stroudley, who was chief locomotive superintendent of the Highland Railway from 1865 to 1870. Stroudley's cabs were somewhat smaller and had square corners. The cabs in the illustration were standard on the railway until 1898.

Another railway, the locomotive department of which also strongly objected to bogies, was the Great Western, and all the passenger tank engines built at Wolverhampton were of the 0–4–2 type, whilst those constructed at Swindon were of the 2–4–0 type, as in Fig. 208. The latter had outside bearings for the leading wheels only, this design being found preferable as a result of experience gained with forty similar tank engines of 1869–71 with inside bearings. The general dimensions were:—Cylinders, 16in. by 24in.; coupled wheels, 5ft.; leading wheels, 3ft. 7in. diameter; wheel base, 7ft. 9in. + 8ft. 3in.; the boiler, 4ft. diameter inside, contained 234 1¾in. diameter tubes, the heating surface of which was 1072 square feet; total heating surface, 1163.5 square feet; grate, 15.6 square feet; pressure, 140 lb.; tank capacity, 820 gallons; weight, 36¾ tons in working order, of which 26 tons were available for adhesion. These were simple, straightforward engines, which performed a vast amount of hard work for many years;

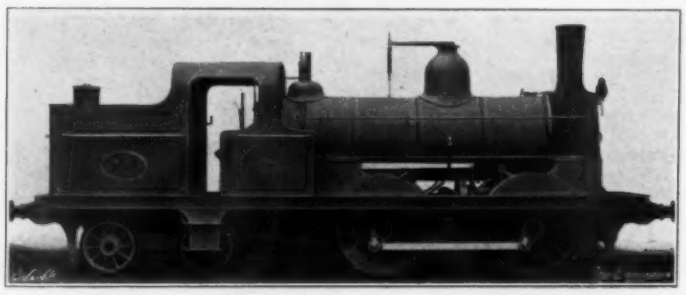


FIG. 209—N.E. BACK TANK ENGINE, 1874

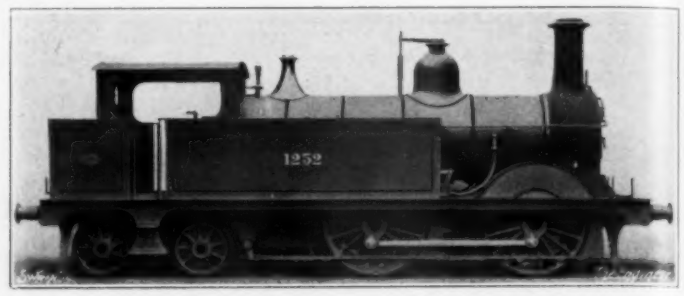


FIG. 210—MIDLAND TANK ENGINE, 1875-6

between Saltburn, Darlington, and thence to Tebay over the steep gradients of the Yorkshire and Westmoreland hills, did not boast of anything in the nature of express trains, though it should be added that from 1875 to 1878 these engines worked one fast train in each direction between Saltburn and Leeds. The type was derived from the four Stephenson's 4–4–0 engines of 1862 previously described—Fig. 155 *ante*—but differed from the latter in several important details. The cylinders were 17in. diameter, with the extremely long stroke of 30in., and until the Great Western adopted a stroke of this length thirty years afterwards these were the only examples of the sort. The piston valves were solid brass discs 13in. diameter, and their expansion in the steam chests, which were without liners, caused no end of trouble. Additional inconvenience resulted owing to the absence of any collapsible rings to allow the escape of water trapped in the cylinders. The bogie, which had 3ft. 7in. wheels and a wheel base of 6ft. 6in., was of a somewhat retrograde design, with a large ball which dropped into a deep socket, but unlike D. Gooch's bogie of 1849 or that of Stephenson's previous engines of 1862 for the S. and D.R., which had a pin extension of the ball, secured by a nut below, Bouch's pivot had no such extension, but only a thin plate at the top, which fitted round a recess machined round the top stem of the ball. This stem was tapered upwards and was secured to the bottom plate of the smoke-box by means of a nut. Altogether it seemed a somewhat perilous bogie to be let loose on an unoffending railway. The boiler contained 210 1¾in. tubes, which were bent downwards at the smoke-box end. The total heating surface was 1217 square feet and the pressure 140 lb. The inside fire-box had a flat top stayed directly to the outer semicircular casing, and the grate was divided into two portions by a very deep longitudinal midfeather. The total wheel base was 6ft. 6in. + 7ft. 3in. + 7ft. 3¼in. = 21ft. 0¼in. The balance weights in the wheels were extensions of the bosses opposite the crank pins. The trailing axle had volute springs in addition to a very wide transverse laminated spring. The boiler was fed by pumps driven from two extra excentrics on the driving axle. The total weight of the last six engines of 1874 was 44 tons 1 cwt., of which 27 tons 7 cwt. were carried by the coupled wheels.

These engines were very far from being a success, and E. Fletcher completely reconstructed them in 1879 to 1881, by scrapping practically the whole of the engine portions, except the centres of the coupled wheels, and reconstructing them as 2–4–0 engines with 17in. by 26in. inside cylinders, and a single pair of leading wheels having inside bearings. The old boilers, minus the fire-box midfeathers, were retained.

The 4–4–0 Highland Railway engines—Fig. 206—were of a very different design, and were directly derived by D. Jones from the old Crewe type of 2–4–0 engine, one of which was converted in 1873 by removing the leading axle with outside bearings and substituting an Adams bogie for the purpose of working over the long branch from Dingwall to Strome Ferry, on which the curves were found too severe for engines with rigid leading axles. The new main line passenger engines were built in 1874 by Dübs and Co., and the design, with only slight modifications in detail and pressure increased to 160 lb., remained standard on that railway for more than twenty years. The outside framing of the old design was

Passenger Tank Engines.—W. Stroudley's 0–4–2 side tank passenger engines for the L.B. and S.C.R., of which there were 125, built from 1873 to 1887, are illustrated in Fig. 207. The cylinders were 17in. by 24in.; diameter of coupled wheels, 5ft. 6in.; of trailing wheels, 4ft. 6in.; wheel base, 7ft. 7in. + 7ft. 5in. The heating surface varied, but the thirty-five engines built by Neilson and Co., of which the illustration shows one, had a total surface of 1029 square feet, of which the fire-box provided 85 square feet; grate area, 15 square feet; pressure, 140 lb., subsequently increased to 150 lb.; tank capacity, 860 gallons; average weight in working order 38½ tons, with 27 tons on the coupled wheels. These engines embodied all Stroudley's special features, several of which have been previously mentioned. The arrangement of exhaust ports was peculiar; they were 2½in. wide, divided into two portions each 7½in. long. The exhaust from the upper portion travelled directly to the blast pipe, but that from the lower part was taken through a passage completely round the cylinders, and connected with the exhaust from the upper ports. The reason for this was that, to allow adequate dimensions for the crank axle, the centres of the cylinders were only 2ft. 2in. apart, which limited the space between them. Similarly, the steam ports were also divided, the two portions being, so to speak, moved upwards and downwards. This gave a clear space in the middle for the steam to pass freely from one end of the steam chest to the other. These cylinders were cast separately, but Stroudley in his larger engines cast both in one piece. He never built an engine of any class with a bogie, which he considered an unnecessary expense.

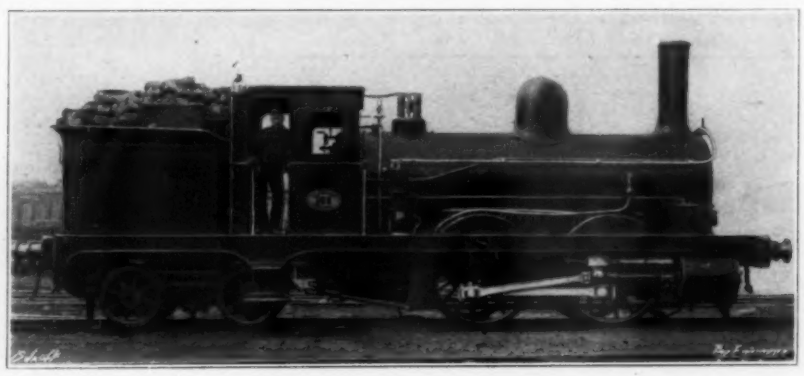


FIG. 211—CALEDONIAN TANK ENGINE, 1873-4

The 0–4–4 type of tank engine, with trailing bogie, was built to M. Kirtley's designs for the Midland Railway in 1869–70, following the lines of Cudworth's earlier engines of 1866. These were somewhat old-fashioned engines, with double frames for the coupled axles and the tank at the back carried on the bogie. Some engineers of that day, notably P. Stirling and E. Fletcher, preferred this arrangement of tanks for the reason that as the tanks emptied the weight on the coupled wheels was not affected to such an extent as when side tanks were used. For the Great Northern, Stirling in 1868–1871 used 0–4–2 back tank engines, with an Adams radial trailing axle. In 1872 he substituted a bogie for the latter, and maintained this design for forty-eight engines, until 1881, when he adopted side tanks.

The best-known examples of the back tank design were Fletcher's North-Eastern engines of 1874–1883, of which the first series—Fig. 209—were built by Neilson and Co. The cylinders were 16in. by 22in.; the diameter of coupled wheels 5ft., and of bogie wheels 3ft.; wheel base, 7ft. 8in. + 9ft. + 5ft.; total, 21ft. 8in.; total heating surface, 1163 square feet; pressure, 140 lb. The weight was about 43½ tons, but later engines, by R. and W. Hawthorn, with slightly longer boilers and larger tanks, weighed 46 tons 3 cwt., of which 20 tons were carried by the bogie when the tanks and bunker were full. Later engines of the type built at Gateshead, 1880–1883, had 5ft. 6in. coupled wheels, with 17in. by 22in. cylinders.

The standard 0–4–4 side tank engine with inside

in fact, the same type, but with longer side tanks, was built at Swindon until the end of 1899. The valve-rods in the earlier engines were suspended by swing links from a bracket attached to the top of the motion plate. A feature, to which attention may be directed, was the long "open-plated" springs, which were standard on the Great Western. These, when loaded, were 4ft. 6in. long by 4in. wide; between each main plate, short plates, ¼in. thick, were interleaved, the length of these being 8in. at the top and 6in. near the bottom. The two lowest main plates had no short plate between them. These springs were used on account of the old longitudinal sleeper track, which was hard and unyielding.

frames, which has been and is still used on so many British railways, was first brought out by S. W. Johnson on the Great Eastern Railway in 1872–3, when thirty engines were built by Neilson and the Avonside Engine Company to his designs. They were similar in general appearance to the later Midland tank engines—Fig. 210—by Neilson in 1875–6, also built to Johnson's designs, but the G.E. engines had sheet weatherboards only, whereas the M.R. engines had cabs. These locomotives were conspicuous for neatness of design and finish. The dimensions of the Midland engine illustrated were:—Cylinders, 17in. by 24in.; coupled wheels, 5ft. 6in.; bogie wheels, 3ft.; wheel base, 8ft. + 8ft. 9in. + 5ft. = 21ft. 9in.; heating surface of 221 1¾in. tubes, 1099.4 square feet; of fire-box, 110 square feet; total 1209.4 square feet; grate, 17.5 square feet; pressure, 140 lb. Weight in working order, 43½ tons, of which 15 tons 8 cwt. were carried on the bogie. When empty, the total weight was 37 tons 4¼ cwt., of which 12 tons 3¼ cwt. were carried on the bogie. There were 217 engines of this type built for the Midland from 1875 to 1900. In the latest examples the coupled wheels were reduced to 5ft. 3in., the cylinders increased to 18in. by 24in., and the pressure to 150 lb. With larger tanks and coal capacity the weight in working order was about 52 tons, of which 21 tons 2 cwt. were carried on the bogie.

The only other type of passenger tank engine to be mentioned is shown in Fig. 211, and represents a design to be found abroad and in America. In the United States it was known as the Forney engine, and has outside cylinders and the tanks at the back over the bogie. It never took root in this country owing to the objection to outside cylinders, and the four engines built by Neilson and Co., 1873–4, for the Caledonian Railway, of which one is illustrated, were, with exception of one Fairlie engine to be mentioned later, the only examples on the standard gauge. The cylinders were 17in. by 22in.; diameter of bogie wheels, 2ft. 8in.; and of coupled wheels, 4ft. 8in. The latter were placed somewhat closely together, the coupled base being only 5ft. 9in. The bogie wheel base was 5ft. and the total 20ft. 9in. The officially recorded weight in working order was 42 tons 3½ cwt., of which 16 tons 3 cwt. were carried on the bogie. When empty the total weight was 33 tons 11¾ cwt., with only 10 tons 0¾ cwt. on the bogie.

Figs. 204 and 205 are from photographs by Mr. R. E. Bleasdale, Warwick, and Figs. 207, 208 and 211 from photographs by the Locomotive Publishing Company, Ltd., London.

Waterloo Temporary Bridge.

No final decision has yet been arrived at as to whether Waterloo Bridge across the Thames is to be pulled down and an entirely new structure erected in its place, or whether some attempt shall be made to preserve the material and general form of Rennie's admittedly beautiful bridge in a widened and strengthened condition. The piers of the bridge are, as is well known, carried on timber piling, and in the course of time one at least of them has become worn out. The crippled condition of the neighbouring arches has for some time been a familiar sight to Londoners. A good impression of the state of the bridge will be obtained from the view of the defective pier No. 5 taken at low water, which we reproduce in Fig. 1.

There are undoubtedly strong artistic and sentimental reasons why Rennie's bridge, which is acknowledged by all to be the most beautiful structure across the London river, should not be destroyed, and a large body of engineers and architects still hold fast to the opinion that it can be preserved. On the other hand, there are those who assert that the works of preservation are impracticable and that, even if the bridge could be restored to its old strength, it should be pulled down in order to make room for one of larger dimensions. As to widening the present bridge whilst preserving its present structure, it seems to be generally agreed that that course cannot be considered. The bridge is situated at a sharp bend in the river, and vessels up to 2000 tons deadweight capacity carrying coal to the Wandsworth Gasworks have to pass it. Were the bridge much wider than it is at present, Rennie's arches would assume the form of narrow tunnels, which, in conjunction with the bend in the river, would form an inconvenient obstacle, if not an actual danger, to ships and barges passing up and down.

FIG. 1—VIEW OF DEFECTIVE PIER NO. 5 OF WATERLOO BRIDGE

This factor of providing freedom for navigation, of avoiding anything in the nature of a tunnel, had to be carefully considered in planning the temporary bridge which, whether Rennie's structure is to be repaired, widened or replaced, will be in service for the next ten years or so. Indeed, the factor in question gives rise to the chief feature of interest in the construction of the bridge, the only important feature in fact which raises it out of the commonplace. For its main length the temporary bridge is situated parallel with the old bridge on the downstream side with a clear gap of some 45ft. between the two. The spans at each end, as shown in the general arrangement drawing—Fig. 2—are inclined relatively to the others in order to connect the bridge with the existing approach roads on the North and South banks. To prevent obstructing the flow of the river, it was essential to place the piers for the temporary bridge in line with the piers of the old one, but had this plan been carried out uniformly across the river, the old and the new piers would have constituted tunnel-like passages that would have effectively barred the river to many of the vessels using it. One pier for the temporary bridge had, therefore, to be omitted. In this way a navigation span tallying with two of Rennie's arches was provided. The situation was additionally complicated by the fact that the first arch of Rennie's bridge on the north side spans the busy Victoria Embankment, while the second, third and fourth arches being on the concave and therefore deeper side of the river, are those principally used for navigation purposes. In addition, the fifth and sixth arches are completely closed by timber work inserted to shore them up.

The first and second spans on the north side are collinear and inclined to the old bridge. Each has a length of 140ft., but they are joined together so as to form a continuous girder over three supports. The first span across the Embankment roadway was erected on special steel staging. The second, in order to avoid obstructing navigation on the busy side of the river, was cantilevered out from the first—see Fig. 5. On the south side there are five independent 140ft. spans, one inclined to, and four parallel with, the old bridge. Of these spans two were erected on centering and three were cantilevered out—see Figs. 6 and 7.

The gap between the two northern and the five southern spans measured 280ft., and is bridged by an independent hog-backed span. This span, corresponding to Rennie's third and fourth arches, could not be erected on centering without confining navigation largely to the second arch during the period of erection. It was essential, in fact, to keep the second, third and fourth arches of the old bridge free from obstruction throughout the whole of the constructional period.

The possibility of erecting the span on land or on a staging in the river and subsequently floating it into position was considered. Its dimensions made the task of bringing it through any of the existing bridges an impracticable one, so that the reach of the river between Blackfriars and Waterloo Bridges appeared to offer the only possible site for its erection. There were objections, however, to such a procedure. There was no site on land readily available. A staging in the river on the south side, the only possible one, would have interefered with the trading interests at the adjoining wharves, and the height to which the span would have had to be lifted would have rendered landing it on the cylinders a very risky operation in the strong tide-way.

The unusual, although perhaps not wholly unprecedented course was followed of erecting the 280ft. navigation span on the roadway of the old bridge and of launching it sideways downstream into position across the gap. This procedure involved moving the span laterally through a distance of 93ft. and of lowering it through about 12ft. on to its piers. It might be thought that to erect a steel structure weighing some 500 tons on the roadway of a bridge that was patently giving way, was a risky proceeding. Actually, however, the stoppage of vehicular traffic across the bridge

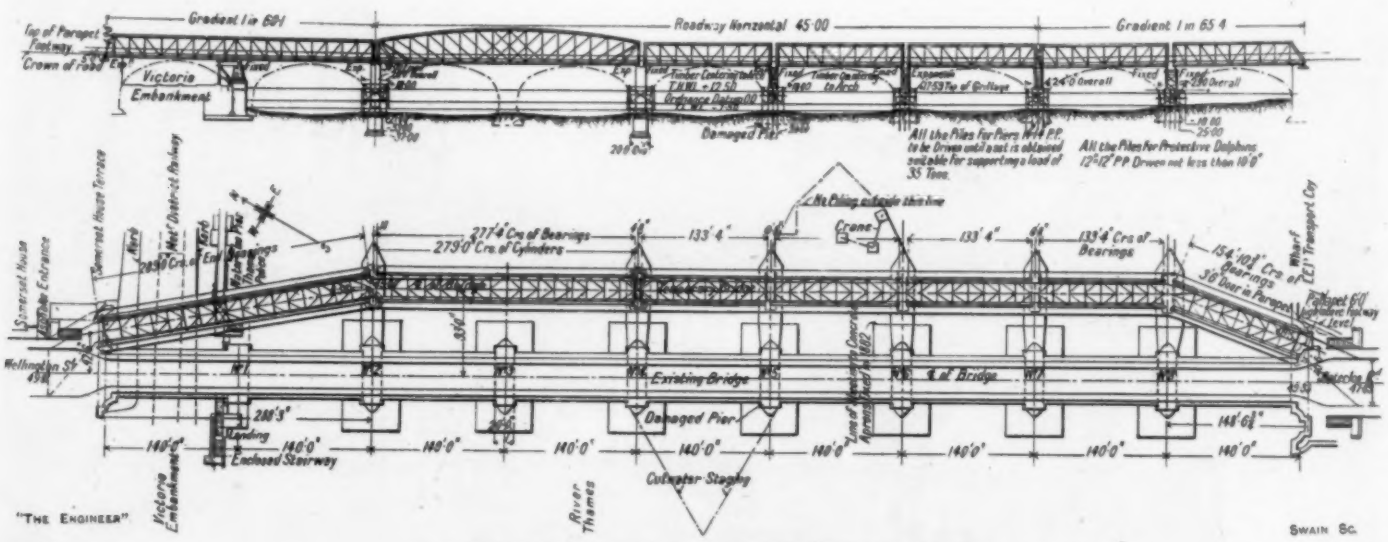


FIG. 2—ELEVATION AND PLAN OF WATERLOO TEMPORARY BRIDGE

before the erection of the naviagtion span was begun, relieved the old structure of a load not far different from that thrown upon it by the weight of the span. Moreover, the removal of the parapets and other portions of the stone bridge to permit the span to be launched at a lower level than would otherwise have been imposed, reduced the weight on the old piers in keeping with the rate at which additional load was applied by the erection of the span. The stones have been carefully numbered, and are being preserved at the London County Council's depôt at Barking.

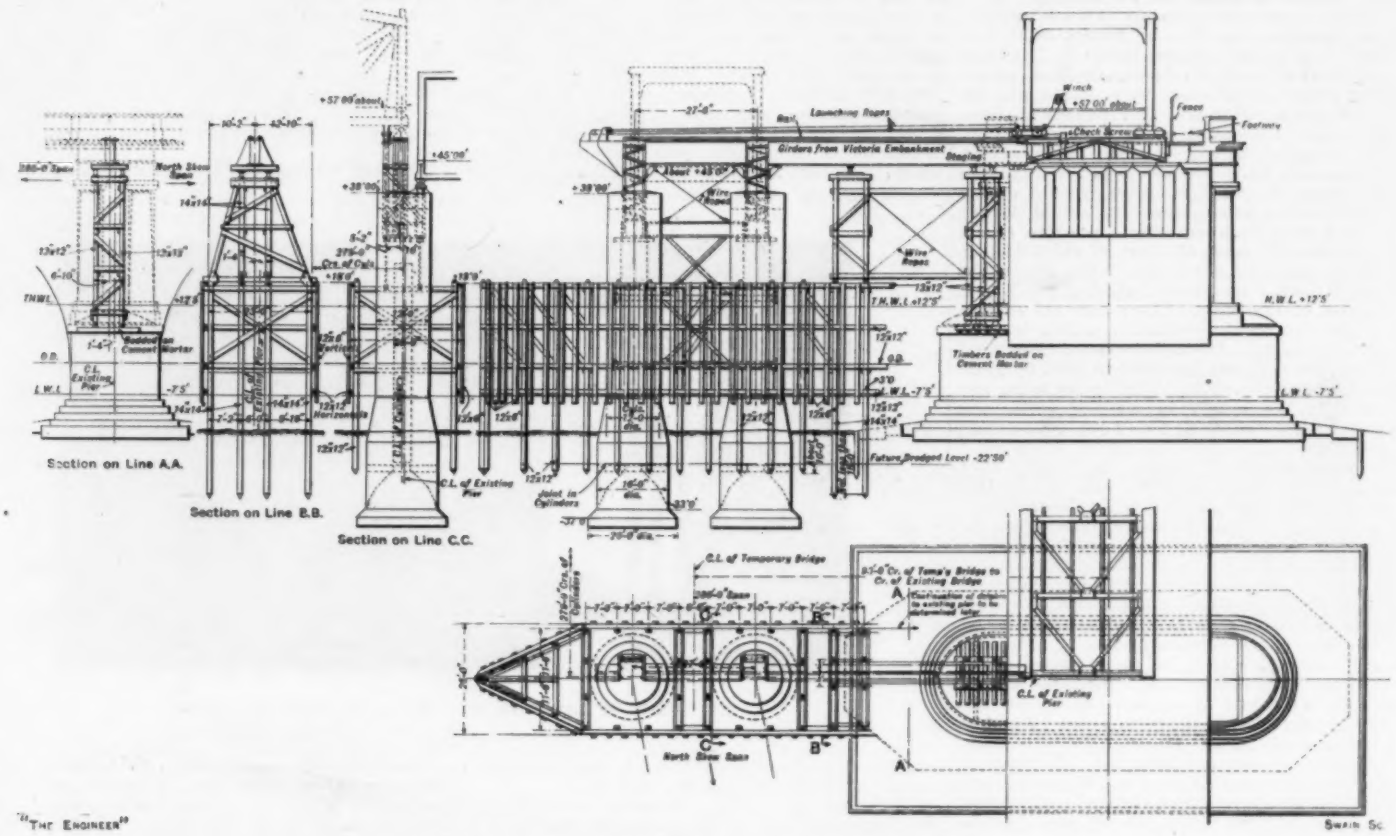


FIG. 3—LAUNCHING ARRANGEMENTS FOR THE NAVIGATION SPAN

The piers for the temporary bridge consist in general of steel work trestles supported on timber piles driven into the bed of the river—see Fig. 6. For the navigation span, each pier consists of a pair of riveted steel cylinders 12ft. in diameter at the top, extending to a level 24ft. below the river bed, and filled with concrete. In Fig. 4 the two cylinders for the southern end of the navigation span are shown.

A general drawing of the launching arrangements for the navigation span is given in Fig. 3, while in our two-page Supplement we reproduce four detail views taken on the day before the span was launched, and two taken during the lowering operations. The hori-

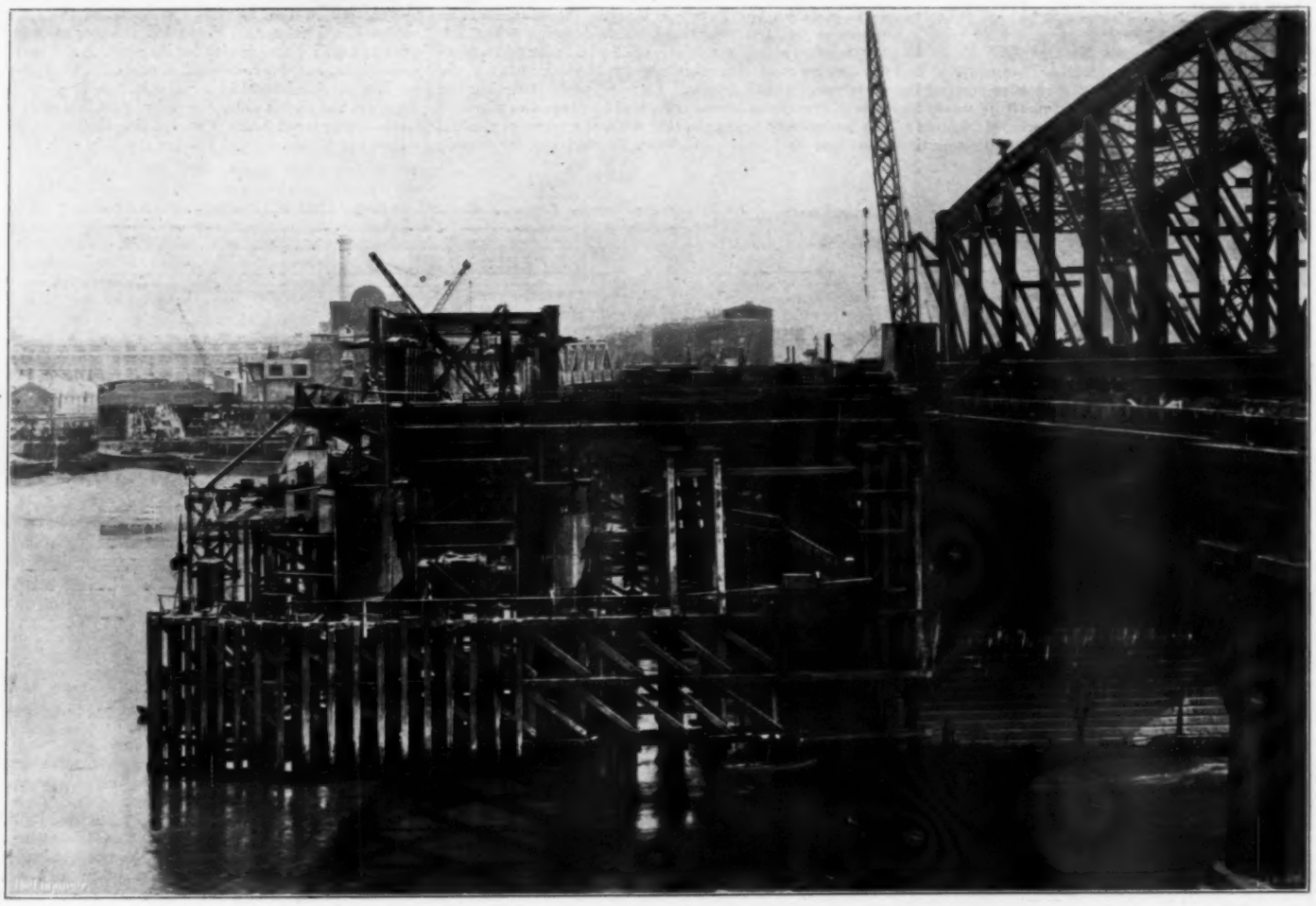


FIG. 4—VIEW SHOWING CONDITION OF WORKS JUST BEFORE SHIFTING THE NAVIGATION SPAN INTO ITS FINAL POSITION

zontal movement of the span through 93ft. was effected by means of hand-driven winches and tackle, while the lowering was carried out by means of four 200-ton hydraulic screw jacks placed one beneath each corner of the span. As will be gathered from the Supplement, four jacks. The trolleys were then run back and the rocker bearings inserted in position beneath the four corners. In the interior of each cylindrical pier, at this stage only partially filled with concrete, there was erected a steel lattice structure provided with

FIG. 5—CANTILEVERING THE SECOND SPAN ON THE NORTH SIDE

the span was erected on blocks on the old bridge, and afterwards transferred on to four 4-wheeled trolleys resting on runways extending from the old bridge across to the cylindrical steel piers. The girders on which the runway rails were laid were, in the interests of economy, the same as those used for the special staging on which, as remarked above, the first span across the Victoria Embankment was erected. The girders were supported at the ends next the old bridge by means of timber work erected on Rennie's masonry dolphins. It was impossible to support the runway girders on the ornamental stone pillars, which form a conspicuous architectural feature of Rennie's designs, for both they and the saddle backs of the cutwaters on which they rested were defective and had to be removed. Intermediately the girders were carried on timber trestles erected on the staging surrounding the cylindrical piers of the temporary bridge.

From a winch anchored on the deck of the span at

FIG. 6—SPAN ON SOUTH SIDE ERECTED ON CENTERING

each end, a steel rope was led over a multiple block mounted on an overhanging bracket on the downstream side of the piers. The two runways were marked with a scale along their sides in order that the span might be moved across uniformly at each end without twist. The trolleys were equipped with brake gear and screwed check rods were attached to the bottom boom of the span in order to limit the movement at each wind to an agreed amount at both ends. Winding operations were begun at 4.30 a.m. on Tuesday, the 16th inst., the early hour of the start being dictated by the absence of traffic on the river and also by the desirability of avoiding temperature effects. By noon on that day the span was in alignment with the ends of the gap, and was ready for lowering. There it was wedged in position and allowed to remain till the following morning.

The general plan of the lowering arrangements was based on the alternate use of jacks and fixed supports, whereby first one end of the span and then the other was lowered in steps of 7½in. When the span had been centered over the piers the weight was taken on the three vertically sliding crossheads fixed as regarded height by means of pins passing through holes spaced 7½in. apart vertically in the lattice structure. On one of these crossheads the jack was placed. The rocker bearing was situated between the two other cross-

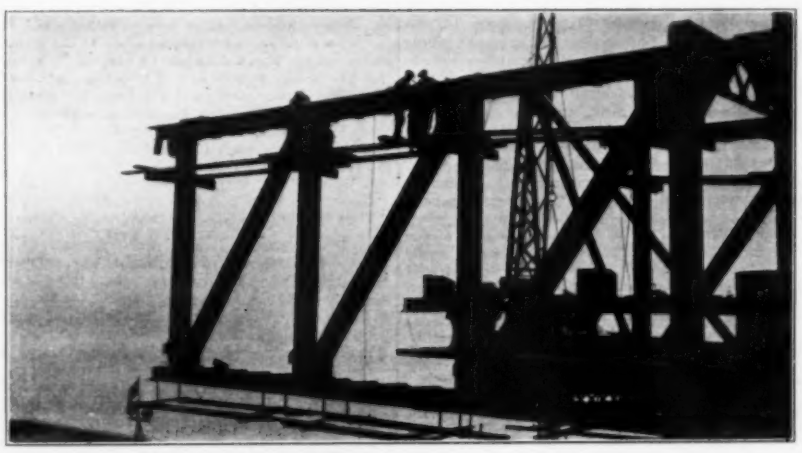


FIG. 7—CANTILEVERING ONE OF THE SPANS ON THE SOUTH SIDE

heads and the bottom boom of the span. With the trolleys run back, and the portions of the runway girders between the lattice structures removed, the jacks were lowered until the weight of the span was transferred on to the rocker bearings and their crossheads. The jack crossheads were thereupon lowered 7½in., and the jacks run out until they were again taking the load. Thereafter the pins supporting the rocker-bearing crossheads were withdrawn and these crossheads having been lowered, the jacks were run down until the bearing crossheads were once more supporting the load. This process was repeated with a drop of 7½in. at a time alternately at each end until the whole drop of about 12ft. had been accomplished. As the crossheads were lowered the diagonal bracing of the lattice structures was progressively unbolted and removed. Work on this portion of the undertaking was begun at 6 p.m. on Thursday, the 18th, and by 5.15 p.m. next day the span had been lowered into its final position. There was an interval in the lowering operations from 8 p.m. on the first day to 7.30 a.m. on the second. It then remained to remove such portions of the lattice structure as projected above the top of the cylinders, and to fill the cylinders with concrete to the top.

In view of the fact that in the course of ten years or so the bridge will have to be dismantled, it has throughout been erected entirely with turned and fitted bolts and nuts, the only field rivets used being in the plates forming the working chambers of the four cylindrical piers. In this way dismantling will be rendered easy. As regards the 280ft. navigation span, we understand that when the time comes for its removal, it may be floated off its bearings under the action of the tidal rise, the operation of taking down the span being less risky and creating less obstruction than building and floating it on to the bearings.

An interesting detail in the design of the bridge is the arrangement made for accommodating the expansion and contraction of the roadway. In these days of high speed, heavy motor traffic, a simple gap in the roadway would have been objectionable and would have given additional trouble by reason of the considerable amount of sheep and cattle traffic across the bridge. Some form of close fitting freely expanding joint was required, and in Fig. 8 the plan adopted is illustrated. The arrangement is, it is said, novel. It consists of a pair of steel castings with interlacing fingers, one casting being attached

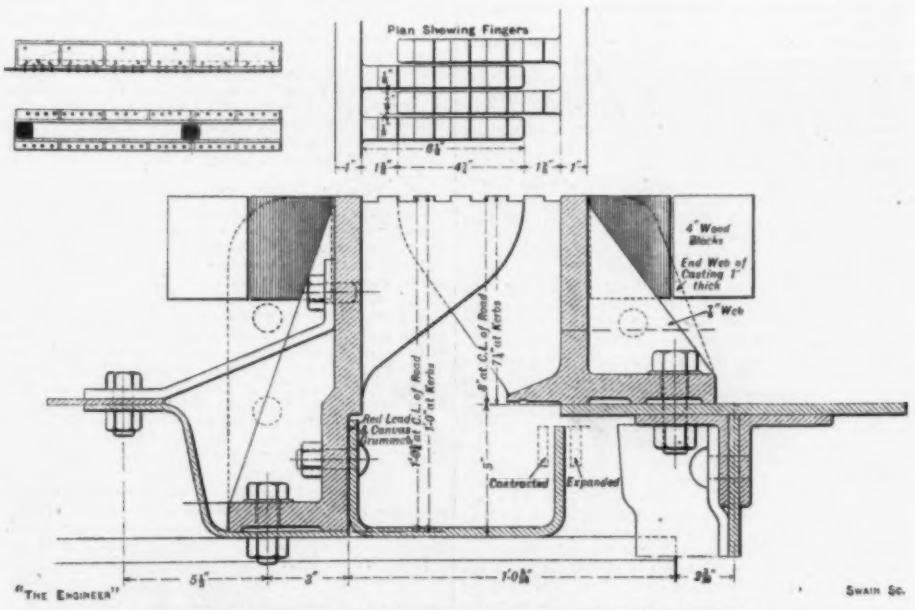


FIG. 8—ARRANGEMENT OF EXPANSION JOINT IN TEMPORARY BRIDGE

to the anchored end of one span and the other to the expansion end of the adjacent span. Endwise expansion and contraction of the roadway can thus take place without interruption to the support of wheeled

traffic and, in addition, relative movement of the spans in a crosswise direction should it arise can be accommodated. The fingers are checked on the top surface to provide a foothold, and below them a pressed steel gutter is suspended to catch rain water, sweepings, &c. There is one such expansion joint at each pier except the first, for over that pier the first and second spans as previously stated are continuous.

The work of erecting the bridge is in the hands of Sir William Arrol and Co., Ltd., Dalmarnock Ironworks, Glasgow. The design of the bridge and the method of erecting it are in accordance with plans submitted by the builders. The contract is being carried out on the "time and lime" basis. The direction of the work on the part of the builders has been undertaken by Sir John Hunter, the company's managing director, and by Mr. Adam Hunter, the company's chief engineer. Mr. J. S. Ramsay is the firm's agent in charge. On behalf of the London County Council, the work has been superintended by Mr. G. W. Humphreys, the Council's chief engineer, and by his chief assistant, Mr. W. C. Copperthwaite. Mr. F. S. Habell has acted as the Council's resident engineer.

Immediately after the navigation span was clear of the old bridge work was begun on restoring the old structure to a condition suitable for pedestrain and slow vehicular traffic. It is anticipated that the old bridge will be ready for such traffic by midnight on Sunday, the 28th inst. The new temporary bridge will, it is intended, be ready for traffic some time in the early days of August.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

STEAM WAGON TRANSPORT.

SIR,—It is impossible for users of heavy transport vehicles to ignore the increase in the employment of steam wagons for the more arduous road transport work. A steam-driven vehicle has peculiar advantages in this field, not only on account of its economy, but owing to the well-known ability of the steam engine to do always a little more than its rating when it is required. In times past the steam wagon was looked upon as too slow for journeys of any distance, and even now some haulage contractors who do not keep in touch with modern design and the capabilities of this form of vehicle still labour under that delusion.

Thanks to the development of the undertype design, we have a steam wagon that can at least hold its own with a petrol vehicle of equal capacity, so far as speed is concerned, and is far ahead of it in fuel economy. The writer has many results of trials with loads of 6 tons and 10 tons, the latter with a trailer wagon, where the average speed is from 15 to 16 miles an hour, even in very hilly districts. The fuel consumption with 6-ton loads on this type of wagon has consistently been from 16 miles and upwards per hundredweight of Welsh coal burnt, depending, of course, on the nature of the road. A six-wheel wagon will take a load of 10 or 12 tons at an average speed of 15 or 16 miles per hour and a fuel consumption of round about 16 miles per hundredweight. This, in fuel alone, shows a marked economy over the fuel consumption of six-wheel petrol vehicles of a like capacity.

The trend of modern design is very distinctly in favour of the undertype wagon, as this form has many advantages. For a fixed length of platform the overall length of an undertype wagon will be about 4ft. less than that of an overtype wagon of similar capacity. This feature helps greatly when manœuvring in confined spaces. The undertype wagon is also much more comfortable and cleanly to drive than the overtype, and gives a better view of the road from the driver's seat than either an overtype wagon or a petrol vehicle; in fact, the only road transport design that can approach it in this respect is the electric battery vehicle. Its comparative cleanliness is specially advantageous when it is used for furniture removing or for the haulage of delicate fabrics, as it is possible for the driver and stoker to keep themselves reasonably clean if required to assist in unloading.

Again, in the overtype wagon a locomotive boiler is employed, having the usual fire tubes, and careful driving is necessary if leaking tubes are to be avoided. A further disadvantage, in the writer's opinion, is that the ratio between tube diameter and length is so much less than in high-class locomotive boiler practice that the hot gases pass through into the smoke-box before they have had time to give up their heat to the water; hence the poor efficiency of this class of boiler for this particular work. That this is so is obvious, when it is borne in mind that the temperature of the gases in the smoke-box in overtype wagons often reaches 1100–1200 deg. Fah., indicating the great waste of fuel that is occurring.

One of the first considerations in the design of any road vehicle, more especially one for business purposes, is simplicity. This is rendered particularly easy in a steam vehicle, because one depends upon steam pressure to give the necessary torque for starting instead of upon the engine speed, as in the case of a petrol-driven vehicle, which consequently entails the use of gearing. By suitably designing the engine of a steam wagon it is quite possible to make an entirely satisfactory vehicle without any intermediate gearing between the engine and the driving chains or other final drive. This scheme has been adopted by a well-known maker with extraordinary success in the design of an undertype wagon. The writer happens to know of an instance where such a wagon drawing a trailer hauled a load of 18 tons from Gloucester to Birmingham without the slightest trouble or hitch of any kind. Such heavy duty goes to show how really superfluous gearing is for this type of transport vehicle.

In the undertype wagon the boiler is almost always of the water-tube design, which has many advantages. The efficiency is high and trouble from tube leakage is greatly reduced because the tubes are not so seriously affected by sudden inrushes of cold air due to points inherent in the design. One of these is that the furnace and tubes are all in contact with water of the same temperature and this, combined with generally shorter tubes, minimises the effect of sudden contraction owing to a rush of cold air into the furnace when stoking. In a fire-tube boiler, if the door of the furnace is opened to stoke, say, when the boiler is steaming hard going uphill, the contents of a fire tube, which ordinarily may reach a temperature of 2200 deg. Fah. at the fire-box end, are suddenly cooled to a temperature of possibly a matter of 800 deg. Fah. But the most important advantage in this respect is that the cold air in the vertical central-fired boiler has first to pass through the stoking tube, which raises its temperature to a certain extent and, further, the speed at which the air travels causes it to impinge on the fire and mix with the hot gases leaving it, so that it becomes very much raised in temperature before it reaches the hot surfaces of the boiler.

In the undertype wagon the whole responsibility rests with the driver, while in many overtype wagons one man steers and the driver attends to the running of the engine and stoking of the boiler. This divided responsibility is very undesirable, as it is utterly impossible in case of emergency to be sure that two brains will act on the same lines independently.

The undertype steam wagon lends itself to designs that enhance the comfort of the driver and stoker. It is possible to fit a windscreen that is removable, if a suitable type of cab is adopted. This screen keeps the men comfortable in inclement weather, while allowing them plenty of air. By removing it in warm weather comfort is again secured in the summer months. Furthermore, the engine being totally enclosed and placed under the chassis, continuous oiling by hand is obviated and also the unpleasant flinging of drops of oil upon the men, which occurs in the alternative design.

Sometimes the objection is raised to the time lost by steam wagons while picking up water. Ten years ago this might have been considered a reasonable objection, but to-day, with steam wagons travelling 40 miles on a tank of water, it no longer carries any weight. This is not only a test figure, but is a common daily experience with many reasonably good drivers. As a tank of water can be filled in from seven to eight minutes a loss of time averaging fifteen minutes to twenty minutes at the outside is scarcely a matter for complaint, especially when the low cost of running compared with other means of transport is taken into account on a journey of a hundred miles.

A point that builders of steam wagons might well give some attention to is the question of raising steam in a morning. This undoubtedly causes many people who would otherwise employ steam wagons to use other methods of road transport. A careful driver, who keeps his boiler fittings in good order and free from leakage, can, by filling his boiler and banking his fire over night, be running next morning in fifteen to twenty minutes. This, of course, is exceptional, so is the man. A driver of average ability will get away in about thirty minutes, while a careless one will take an hour or even more. If the wagon is in use where steam is available a considerable amount of time may be saved by having a small special fitting attached to the boiler shell in the water space. This fitting can be coupled by a flexible pipe to the live steam supply and the steam gradually introduced, thus heating the water while the fire is being raised. Where a fleet of steam wagons are employed arrangements are generally made for one man to come early, whose duty it is to get up steam in all the wagons ready for the drivers when they arrive.

June 22nd. AURIGA.

"THE BRITISH STEAM RAILWAY LOCOMOTIVE FROM 1825 TO 1924."

SIR,—In reference to the statement made regarding the balancing of locomotives in this week's issue, under the above heading, it may be interesting to know that Mr. James Pearson, the locomotive superintendent of the Bristol and Exeter Railway, in his famous 9ft. single-wheel tank engines, only balanced the revolving masses, leaving the reciprocating masses quite unbalanced. These engines had an unusually long bunker and tank behind the foot-plate, more like a short tender, and no doubt for this reason and his actual experience with these engines, Mr. Pearson did not find it necessary to balance the reciprocating masses.

The G.W.R., as soon as they took over the B. and E.R., in 1876, added extra balance weights to the driving wheels of these engines, and the first so altered jumped off the road at Long Ashton, in July, 1876, when running at a speed of 80 miles per hour with the up "Dutchman," a few days after coming down to Bristol from Swindon, where she had been overhauled and altered.

At the Board of Trade inquiry regarding the accident, the unsatisfactory condition of the permanent way was blamed, and the leading platelayer was reprimanded for his lack of knowledge regarding the super-elevation of the outside rail on a curve, but they had plenty of this on the down road of the new Bristol Joint Station at that time, for, although I was only seven years of age, I well remember going along to see the engine of the train I was travelling by, and I noticed how it was leaning over towards the platform, and the climb to get from one side of the carriage to the other. This was about a week before the accident. This accident ended the career of these engines as 9ft. single-wheel tank engines; the one in the accident was scrapped and the others converted to 8ft. single-wheel tender engines.

When I was a boy at school in the city of Bristol, I was taught, in the science class, that the cause of the accident was insufficient space for expansion, and subsequently when I was serving my apprenticeship to engine fitting, at the old B. and E.R. shops, I was told by the men who had built these engines and overhauled them for several years and who had gathered up the pieces after the accident, that the axle-boxes of the bogies had been fitted too tightly in the horns at Swindon. This opinion agreed with that of Wm. Dunscombe, the driver, who with his fireman was killed in the accident, having told my father, within twenty-four hours of the accident, that his engine was riding very badly, and that she would either have him up in the hedge or down in the ditch. The B. and E.R. permanent way was rather "ripe" at the time, and when I noticed in two photographs of these tank engines that there had been a large increase in the balance weights fitted by the G.W.R., it struck me that this was just the thing to find out the "soft" places of the permanent way and spread the road. The driving wheels were loaded to 18 tons, and the balance weights on top of this were the "last straw," especially at the speed already mentioned.

WM. HY. ROBSON.

London, June 23rd.

SELF-CONTAINED PULVERISING UNITS.

SIR,—I have decided after concentrated examination of local requirements of industry to throw in my weight, for what it is worth, in favour of the self-contained coal pulverising unit for general applications in Great Britain.

As an investigator of systems I have held aloof during the past five years from forming any definite decision, but the present period of financial distress among the coal-using sections of British manufacturers clearly points, in my opinion, to the only possible solution so far as the use of pulverised coal is concerned, the installation of the self-contained unit. British types of such units lie in the medium capacity category, from 5 cwt. to 2 tons of coal per hour. Both smaller and larger units are necessary to complete the range required for industrial applications, and in Germany the 2-cwt. unit, and in America the 7-ton and 10-ton units, have made their successful *debut*. It is not realised that upwards of a thousand such installations have been made in various countries during the past two years or so.

I am convinced that only in the cases of large power station plants and for isolated industrial instances when heavy capital expenditure can be arranged, will the complete central pulverising equipment, in spite of its acknowledged superiority, be installed. There is no doubt that the complete central plant is the better for the heavier applications of fuel for power and other purposes, but there are tied up therewith so many unnecessary and costly items and royalties that the combined cost of plant and combustion chambers frequently reaches an exhorbitant figure.

The self-contained unit, the local supply of pulverised coal to small consumers, and the group ownership of a central plant are the broad lines which present indications and requirements suggest will be the course of pulverised coal development under the financial stringency of to-day. In order to render the unit system the more efficient it is yet necessary to evolve certain improvements, such as a simple and inexpensive dryer for washery slurry and slack coal, a means of ensuring equal fuel supply to a number of burners, a reduced combustion area which will cut down the high cost of furnace chambers while dealing with the ash in solid or liquid form, a simple and efficient flue gas air preheater to work in parallel with the furnace air cooling cavities, better means of controlling the secondary air supply. Much progress has already been made in some of these directions.

The unit pulveriser of large capacity is competing at equal cost with mechanical stokers in America; the very small unit is undoubtedly destined to follow in Great Britain its successful appearance on the Continent. Moreover, it is not beyond the bounds of possibility that the unit turbo-pulveriser will prove its reliability and flexibility for locomotive and marine uses.

It is therefore time to be engaged upon constructive economy work throughout our own industries on lines which are within their means, instead of arriving nowhere after lengthy discussions as to the respective merits of complete central plants, without any single conclusive illustration in this country—except for power generation purposes—at an inclusive capital outlay away beyond the reach of purchasers of to-day.

I do believe, Sir, that you will find that the self-contained unit, and possibly the group ownership of public supply systems, will outstrip all other pulverised coal proposals in the immediate fuel economy movement so essential to the well-being of our future industrial production. LEONARD HARVEY.

London, June 22nd.

SIXTY YEARS AGO.

FOR very many years engineers in the Royal Navy suffered under the degradation of being classed by themselves in a category quite apart from the deck officers. The Queen's Regulations, according to a leading article in our issue of June 23rd, 1865, referred offensively to "gentlemen" in the statement of qualifications for appointment to naval cadetships, &c., while "persons" was thought to be a good enough designation for those aspiring to the post of assistant engineer. We took up the question and expressed ourselves vigorously upon it, not because we were anxious to remedy a class grievance, but because we saw in the distinction drawn by the Lords of the Admiralty and others between the deck officers and the engineers a factor that might gravely imperil the efficiency of our fleet in a moment of emergency. There was, we maintained, no good reason why an engineer in charge of machinery should not be a gentleman. Yet the Admiralty and all naval officers down to the surgeon's mate persisted in treating them merely as mechanics, and they were rewarded for their services by pay that was notoriously too small—less, in fact, until a few years previously than was received by an ordinary ship's carpenter. It was useless, we contended, for the Admiralty to complain that it could not secure the services of those who as engineers could be placed on a footing of equality with the other officers. The Admiralty itself had done its best to render the engineers' position so objectionable that really good men would not enter the service. The unsatisfactory state of the question was revealed during the formation of the Royal Naval Reserve. That scheme had succeeded in obtaining for the nation in a time of emergency the services of 18,000 trained seamen. It was deemed highly desirable that engineers should join the Reserve, but in the event only three engineer candidates from the merchant service presented themselves for enrolment, and of these three one could not pass his examination and another was too old. The Government was, we wrote, doing much to render naval engineering the most unpopular pursuit in existence, and we expressed the earnest hope that the entire subject would shortly receive proper attention in order that the odium into which an honourable profession had fallen through administrative incapacity might be removed. Our hope was not immediately fulfilled. For many years afterwards the distinction between engineer and executive officers in the Royal Navy persisted. Indeed it was not until 1916, in the midst of the Great War, that naval engineer officers, thanks largely to the advocacy of the late Mr. D. B. Morison, were given military status.

A SPECIAL meeting of the proprietors of the Great Western Railway was held the other day in order to sanction the issue of new stock. At the close of his speech the chairman, after alluding to the serious effect that the conditions in the export coal trade were having upon the railway, said:—"I hope, however, that matters are coming to an issue, and I think one is entited to express a very sanguine hope that the coalfield may before long get back to its old prosperous conditions, to the advantage of all concerned in the collieries and in the trade of the country generally."

The Littleton—Queen Mary—Reservoir and Works.

No. II.*

In our first article we described the intake, the intake channel, the suction basin, and the way in which the delivery pipes for the pumps are taken over the reservoir embankment. We still have something more to say regarding the inlet arrangements, but at this point we may conveniently make mention of the pumping station. We gave, in Fig. 5 *ante*, one view of the building, but a better idea of the size of the structure is perhaps obtained from Fig. 13, which is a front view, the engine-room occupying the centre portion, and access being obtained into the centre of it through the porch. The building, which was designed by the Board's chief engineer, Mr. Henry E. Stilgoe, is of red brick, with Portland stone dressings and a roof of Westmorland slates, and it has a very pleasing and serviceable appearance. Its foundations were constructed by S. Pearson and Son (Contracting Department), Ltd., as part of the main reservoir works, while the superstructure was erected by John Laing and Son, Ltd., of London and Carlisle.

The engine-room is 127ft. long by 59ft. wide. It is lined throughout with glazed bricks and tiles—cream above a green dado—and is equipped with a hand-operated overhead travelling crane, of 12 tons capacity, made by the Vaughan Crane Company, Ltd., of Manchester.

The pumping machinery has been cleverly arranged so as to economise space to the fullest possible extent. In inviting tenders for the machinery, Mr. Stilgoe did not frame his specification on hard-and-fast lines but allowed to prospective tenderers an opportunity of putting forward machinery of their own designs, as long as it conformed to certain general, but very clearly defined conditions. At first therefore it was not known exactly what dimensions would be required for the building, which was not actually designed until the type of pumping plant to be used was settled. In the specification it was stipulated that the plant should comprise not less than four or more than six units, and that the installation, as a whole, was to be capable of pumping from 250 million gallons per day against a head of 46ft. to 343 million gallons per day against a head of 30ft. There were, also, given certain figures of cost of building and of fuels of varying descriptions, cost of labour, &c., which might be taken as bases for calculation, and the choice of machinery was to depend on which of the arrangements offered would, everything considered—cost of operation, sinking fund, estimated maintenance, &c.—provide the most economical combination, the fuel consumption having in all cases to be guaranteed under penalty. As a result, a very interesting series of tenders was received for pumping plants, with various types of prime movers—steam engines, steam turbines, gas engines and internal combustion engines. There was an extraordinary diversity, alike in the types of machinery offered, in prime cost, and in cost of operation.

Twenty-one firms tendered and they sent in a total of no less than thirty-two separate quotations. The prime movers suggested included steam engines, steam turbines and internal combustion engines, while pumps of the Humphrey type were also offered. The amount of the lowest tender was £56,700 and of the highest £129,500, a difference of no less than £72,800. The former was for a combination of water-tube boilers, uniflow steam engines, and centrifugal pumps, the latter for Diesel engines and centrifugal pumps, There were other tenders embodying Diesel engines, the lowest of which was £79,650, or nearly £50,000 less than the first-mentioned Diesel engine tender. The lowest steam turbine tender was £69,300 and the price quoted for Humphrey pumps was £89,500. The three lowest tenders were sent in by the same firm. They differed in the type of boiler and prime mover employed, but were not widely separated in amount. The figures of cost of yearly working were not quite so divergent as were the tenders for the plant itself, but, for all that, they ranged from £27,200 to £36,500. The guaranteed fuel consumption varied from the highest, which was 2.82 lb. of coal per pump horse-power-hour in a steam plant, to 0.525 lb. of oil in a Diesel engine plant. The lowest estimated annual cost was in connection with the plant for which the lowest tender but one was put in.

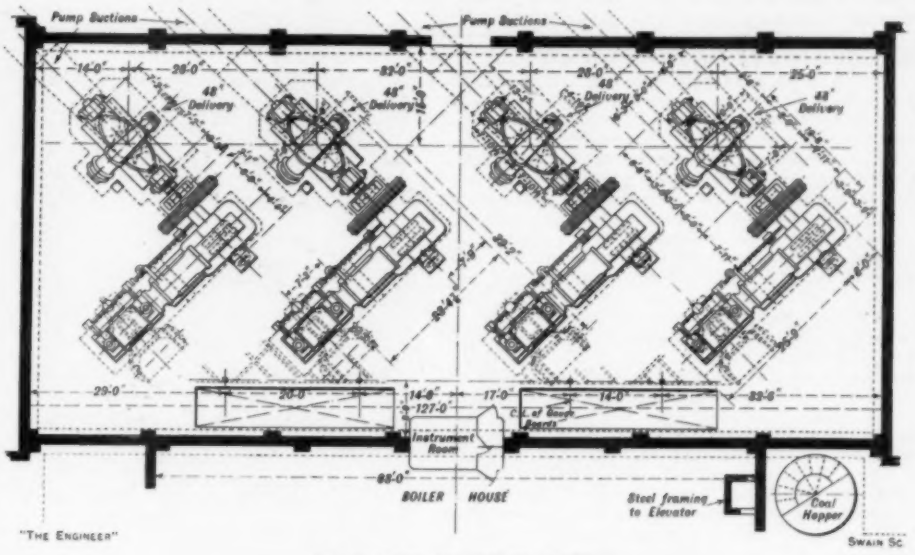


FIG. 14—PLAN OF ENGINE-ROOM

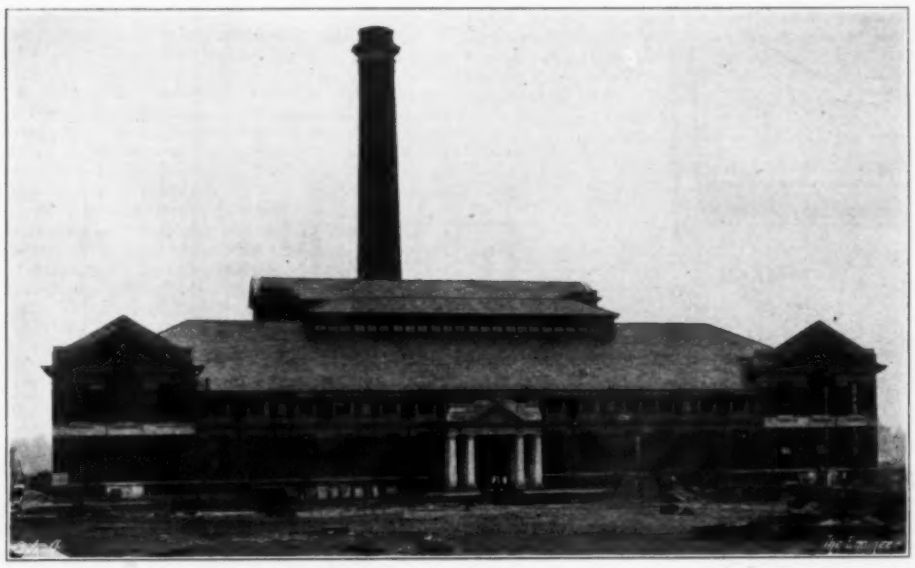


FIG. 13—THE PUMPING STATION AT LITTLETON

In the result, the tender of Worthington-Simpson, Ltd., of Newark, for the whole of the pumping machinery, boilers and economisers, was chosen. It embodied the supplying of four units, each consisting of a single-cylinder uniflow horizontal steam engine driving directly a horizontal-spindle centrifugal pump. In these machines the pump spindles are at right angles to the crank shafts of the engines and the arrangement shown in the plan view, Fig. 14, and to be seen in the interior view, Fig. 15, was adopted, the centre lines of the engines being at an angle of 45 deg. to the centre line of the engine-house. The layout is most compact, and much space is saved as compared with having the machinery placed in any other manner, while at the same time there is ample space for operating the engines and pumps and for getting at any part for cleaning or repair.

The engines, one of which is shown in Fig. 16, have cylinders 28in. in diameter, and the stroke is 39in. They are designed to operate with steam at a pressure of 200 lb. to the square inch, superheated 200 deg. Fah. The pumps are of the centrifugal type with cast iron impellers, 7ft. 4in. in diameter and 48in. deliveries. A flexible coupling of the Wellman-Bibby type is interposed between the crank shaft of the engine and the spindle of the pump. We understand that the following average figures are guaranteed from each of the sets :—

Speed, r.p.m.	Head, feet.	Rate of delivery in million gallons per 24 hours.	B.H.P.	Efficiency, per cent.
125	30	85.7	704	77
130	37	75.0	720	81
140	46	62.5	770	79

Each engine has its own separate surface condenser, with 900 square feet of heating surface, and the circulating water is obtained from the main delivery pipe passing, after doing its work, to the suction

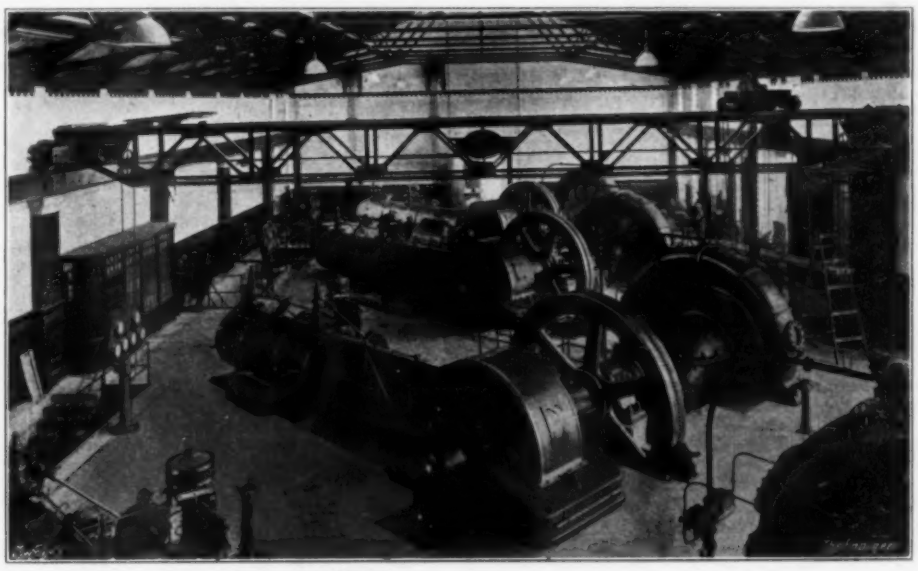
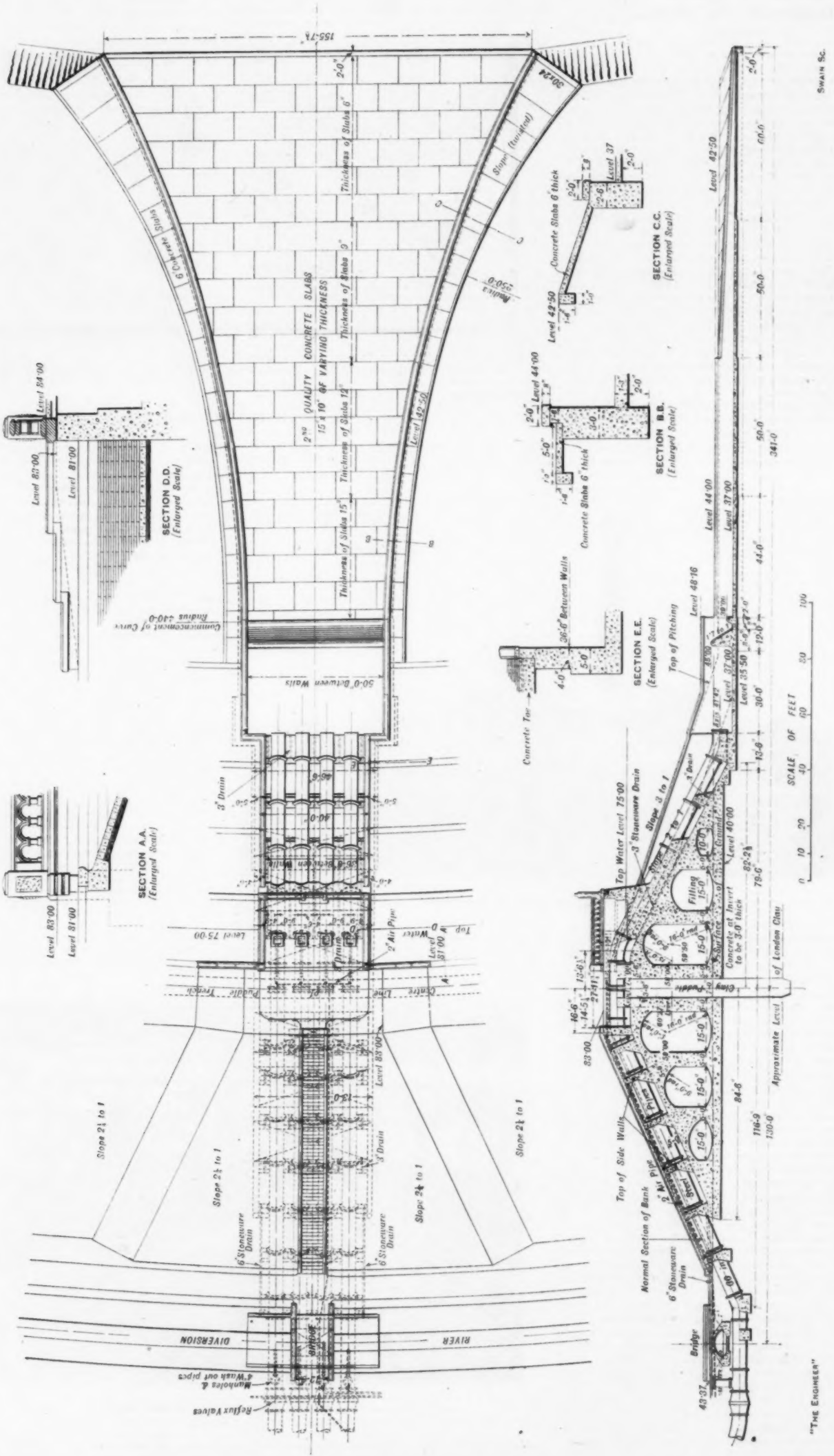


FIG. 15—INTERIOR OF ENGINE-ROOM

* No. I. appeared June 19th.

LITTLETON—QUEEN MARY—RESERVOIR, INLET ARRANGEMENTS

MR. HENRY E. STILGOE, M. INST. C.E., LONDON, ENGINEER



basin. The condensate is withdrawn by an air pump operated from the engine, and is passed by a force pump, similarly driven on to the feed water filters before being returned to the boilers. Make-up water is provided by an evaporator. The condensers

FIG. 16—ONE OF THE 770 B.H.P. WORTHINGTON-SIMPSON UNIFLOW ENGINES

and pumps are contained in the basement below the engine-house floor.

The boiler-house, which measures 88ft. long by 62ft. wide, adjoins the engine-house. It is large enough to contain five boilers, each capable of evaporating 8300 lb. of water per hour, with a working pressure of 200 lb. per square inch. At present, however, only four boilers are in position. They stand in pairs, the two pairs being at a sufficient distance apart for the erection in between them of the fifth boiler, if and when it be found desirable to install it. The boilers were made by the Stirling Boiler Company, Ltd., of London, and each has a grate area of 60 square feet and a heating surface of 2808 square feet. Each boiler is of sufficient capacity to furnish the steam required to operate one of the pumping units, and the arrangement of the steam piping is such that any of the boilers can supply steam to any of the engines, though, ordinarily, each set will have its own separate boiler. The boilers, which are furnished with integral superheaters, Green's economisers, and chain grate stokers of the Babcock and Wilcox type, operate under natural draught supplied by a chimney, 150ft. high. The latter, which is octagonal in form, is of red brick, with a stone base and a stone cap. It is one of the finest looking chimneys that we have seen.

As it was impossible to run a connection from any railway on to the site, it will be necessary for the coal to be taken, along a specially constructed roadway, to the pumping station in motor lorries, which will deliver it into a conical hopper at ground level. From the latter it will be raised by an electrically driven bucket conveyor, made by the Hepburn Conveyor Company, Ltd., of Wakefield, and delivered at will into either one of five reinforced concrete coal hoppers built above the boilers. From these bunkers steel shoots lead down to the stokers of the boilers. Lea recording coal meters being employed to measure the total coal consumption, as well as the quantity burned per square foot of grate area. The conveyor is capable of dealing with 20 tons of coal per hour. Running beneath the boilers is a subway furnished with a line of narrow-gauge rails, along which travel small trolleys. The ashes are delivered into these trolleys which are then pushed by hand to a lift arranged outside the boiler-house, by which they are raised to ground level. Another line of rails runs away to a piece of waste land, which can be used for storage, but we gather that the demand for ashes and clinker is nowadays so great that it will probably not be necessary to store much of it for any length of time.

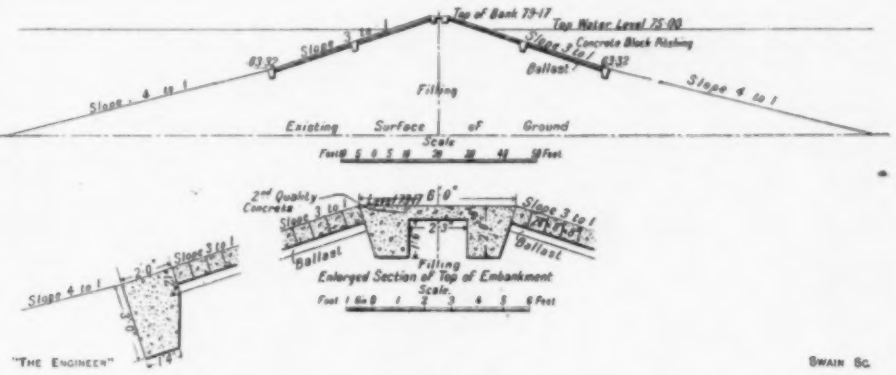


FIG. 18—SECTIONS OF BAFFLE EMBANKMENT

In addition to the four main boilers, there is a small "Economic" boiler supplied by Davey, Paxman and Co., Ltd., of Colchester, which, like the main boilers, works at 200 lb. per square inch. It is intended for supplying steam to two Ashworth and Parker engines, each driving a 25-kilowatt direct-current generator, made by the Lancashire Dynamo and Motor Company, these machines being for furnishing current for working the coal conveyor, ash hoist and other power purposes, as well as for lighting the pumping station and works generally.

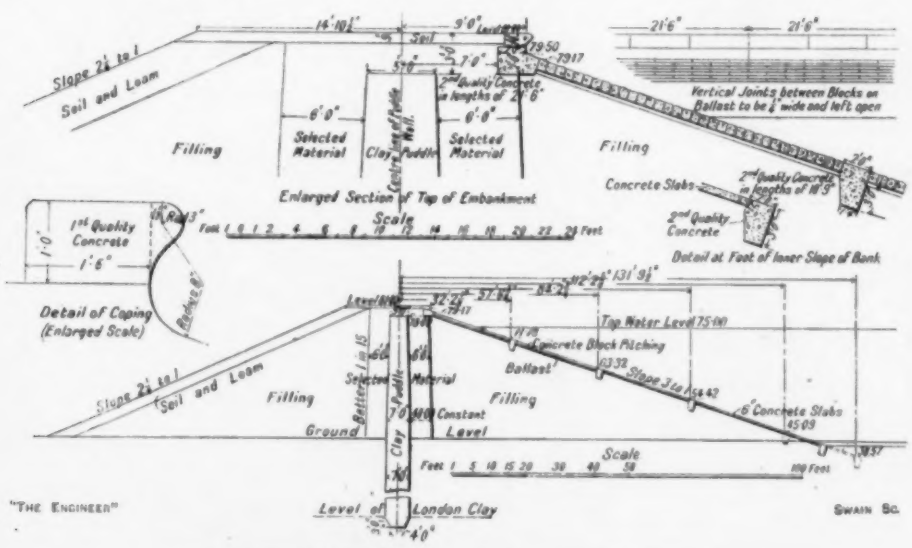


FIG. 17—TYPICAL SECTIONS OF THE RESERVOIR EMBANKMENT

This smaller boiler is at present supplied with coal from the centre hopper of the five overhead hoppers, which is intended for serving the fifth main boiler when it is installed. The boiler is 5ft. 6in. in diameter and 10ft. long, and it will only be used, so we understand, when the main boilers are not in operation.

There is nothing of special novelty in the boiler-house or its equipment, but it appeared to us to be particularly well arranged, and was in beautiful order. Arranged between it and the engine-room, and forming the communication between the two, is a small instrument room, both sides of which are glazed. In it are recording steam gauges, a pyrometer for measuring the temperatures of various parts of the boilers and their settings, a CO_2 indicator, &c. It is furnished with a telephone, which is in communication with all parts of the buildings and works, as well as with the Chief Engineer's office at Rosebery-avenue.

Turning once more to the inlet arrangements, attention may be drawn to page 706, on which appears a general plan and section of this portion of the works. The four 5ft. delivery pipes are carried over the embankment on concrete cradles formed on an arched concrete structure, the form of which is well shown in the engraving. It will be observed that the inlet basin, into which the four delivery pipes discharge, measures 50ft. by about 32ft., and the shape of the weir, of which mention was made in our last issue, will be noticed. The height of the crest of the weir above the floor of the basin is 8ft., which provides ample depth of water for the complete immersion of the ends of the delivery pipes. By this means a syphon action is set up varying according to the height of the water in the reservoir, which considerably reduces the head on the pumps, allowing a larger quantity to be pumped per unit. When the reservoir is full, this weir will, of course, be submerged to a depth of some 30ft., but as, at the time of the opening ceremony, there was only quite a small depth of water in the reservoir, the effect of the reverse curves at the outer toe of the weir was very plainly observable. All four pumps were in operation, and water was entering the reservoir probably at the rate of some 300 million gallons of water per day. Beyond the weir the discharge channel is curved outwards in fan shape, first of all at a radius of 440ft., and then at a radius of 250ft. It is extended outwards into the reservoir for a distance of 206ft., being paved with concrete slabs measuring 15ft. long by 10ft. wide, and of thicknesses varying in steps of 3in. from 15in. just below the weir to 6in. at the toe, the width of the paved portion at that point being 155ft. 7½in. The slabs are laid with their longer dimensions across the channel, and the joints of successive rows are staggered. The shape and dimensions of the walls of the channel are shown in the illustration.

The floor of the reservoir has been practically levelled throughout its full extent, and all traces of organic matter have been removed. In parts, there was encountered a certain amount of very hard conglomerate, comprised of hard flint pebbles bound together with a matrix which has the appearance of containing a not inconsiderable proportion of iron salts. This conglomerate was so hard that, in order to remove it, blasting had to be resorted to. In consequence, wherever it could be allowed to remain without seriously interfering with the capacity of the reservoir, it was left. As has been said, in addition to all the material required for forming the embankment walls, ballast, which was present in great quantity and of excellent quality, and clay for the puddle wall, were also obtained from the site. A typical bank section is given in Fig. 17. The top level of the embankment is at + 81.0 O.D., and the top water level is arranged to come at + 75.0 O.D., so that the water at top level will be 6ft. below that of the parapet of the embankment. The average depth of water when the reservoir is full will be 38ft.

The ordinary method of forming reservoir embankments of this type has been followed. The core wall of clay puddle is bonded 3ft. into the London clay, the width of its toe being 4ft. From the surface of the clay upwards until the level of + 48.0 O.D. is reached, the width of wall is kept constant at 7ft.,

from which point up to level + 78.0ft.—the highest point to which the clay is taken—the wall is gradually tapered to a width of 5.0ft. The clay after adequate weathering and treatment in pugmills, was put in in layers, varying from 3in. to 6in. in thickness, depending upon its depth from the surface, and well trodden in by men. It will be seen that, as the top water level is at + 75 O.D. and the top of the puddle wall is at + 78 O.D., the latter stands 3ft. above the top level of the water. Since the core wall is continuous, and since its foot is securely bonded into the London clay, an entirely impervious basin has been formed, so that neither can water escape from it nor can surface or other water find its way into it from outside.

built *in situ*, in an excellent manner, in lengths of 21ft. 6in., gives a finished and neat appearance to the work. Much of the pitching and slabbing has already been done, but a good deal still remains to be got in. Its absence, however, will not prevent the reservoir being put into service. Indeed, it is possible that some of it will not be laid until the reservoir has been filled and allowed partially to empty, for there is certain to be some settlement when that is done.

The baffle embankment differs in several respects from the main reservoir embankment. In the first place, it has no core wall, and, secondly, its slopes are, in their lower parts, 4 to 1 instead of 3 to 1, though the upper parts are given the latter slope.

constructed with sloping sides, the invert and sides being covered with concrete slabs. The embankment behind the tower is, where it is cut away, held up by a concrete retaining wall, curved in plan.

The water obtains access to the outlet tower by means of seven 5ft. by 6ft. single-faced sluices, actuated by hand gearing, in three tiers, the bottom tier consisting of three sluices. The operating spindles of these sluices are taken up to a platform on the top of the tower. The inverts of the three tiers of sluices are at levels + 63.0 O.D., + 48.5 O.D., and + 34.0 O.D. respectively. It will therefore be seen that by means of the lowest sluices it is possible entirely to empty the reservoir.

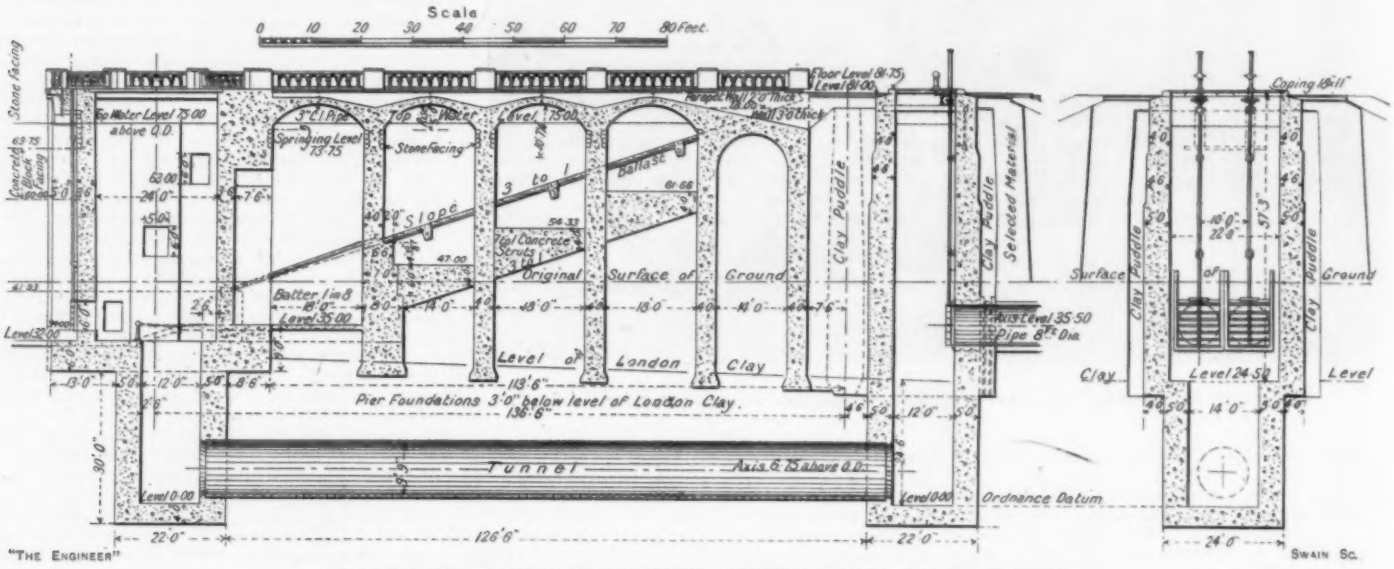


FIG. 19—SECTIONS THROUGH OUTLET TOWER, APPROACH BRIDGE, AND VALVE SHAFT

On each side of the core wall was securely packed specially selected material, outside which again, there is ordinary filling, covered as regards the surface of the outer slope with 3ft. of soil and loam. The slope of the outer side of the embankment is 2½ to 1 and of the inner side 3 to 1. The width at the top of the embankment is about 24ft., and the width at ground level is on an average about 220ft. Eventually, trees are to be planted all over the outside slope of the embankment, but as far as we know, no planting has, as yet, been done.

The inner slope of the embankment is pitched, down to level + 63.32 O.D., with pre-cast concrete blocks measuring 2ft. 8in. by 8in. by 8in., laid on a 4in.

Then, again, they are only pitched with concrete blocks down to level + 63.32 O.D., below which point there are no concrete slabs. Finally, the summit, which is only 6ft. wide, is to be crowned with a concrete cap of the form seem in Fig. 18. Much of this capping and pitching still remains to be done.

The outlet tower is at the north-east corner of the reservoir. Views of it are given in Figs. 22, 23 and 24, page 710, and drawings in Fig. 19. It is built above a shaft, which is taken down into the clay with its foundation at — 4.00 O.D., its floor level being exactly at Ordnance Datum level. The shaft, which is rectangular and measures 14ft. by 12ft., has concrete walls, 5ft. thick, which are taken up to level + 32.00 O.D.,

At a distance of 148ft. 6in., centre to centre, from the outlet shaft another shaft measuring in its lower portion 12ft. by 14ft., and increasing to 12ft. by 22ft. at level + 24.5 O.D., has been sunk down through the reservoir embankment just outside the clay core wall. Its floor level, like that of the outlet shaft, is at Ordnance Datum, and it has a concrete floor, 4ft. thick, and concrete walls, 5ft. thick. Joining the two shafts is a circular tunnel, 9ft. 9in. internal diameter, with its axis at level + 6.75 above O.D., which is lined with cast iron segments exactly as are tube railways. The water flows through this tunnel, and rises in the landward shaft to a level equal to that of the water in the reservoir. This landward

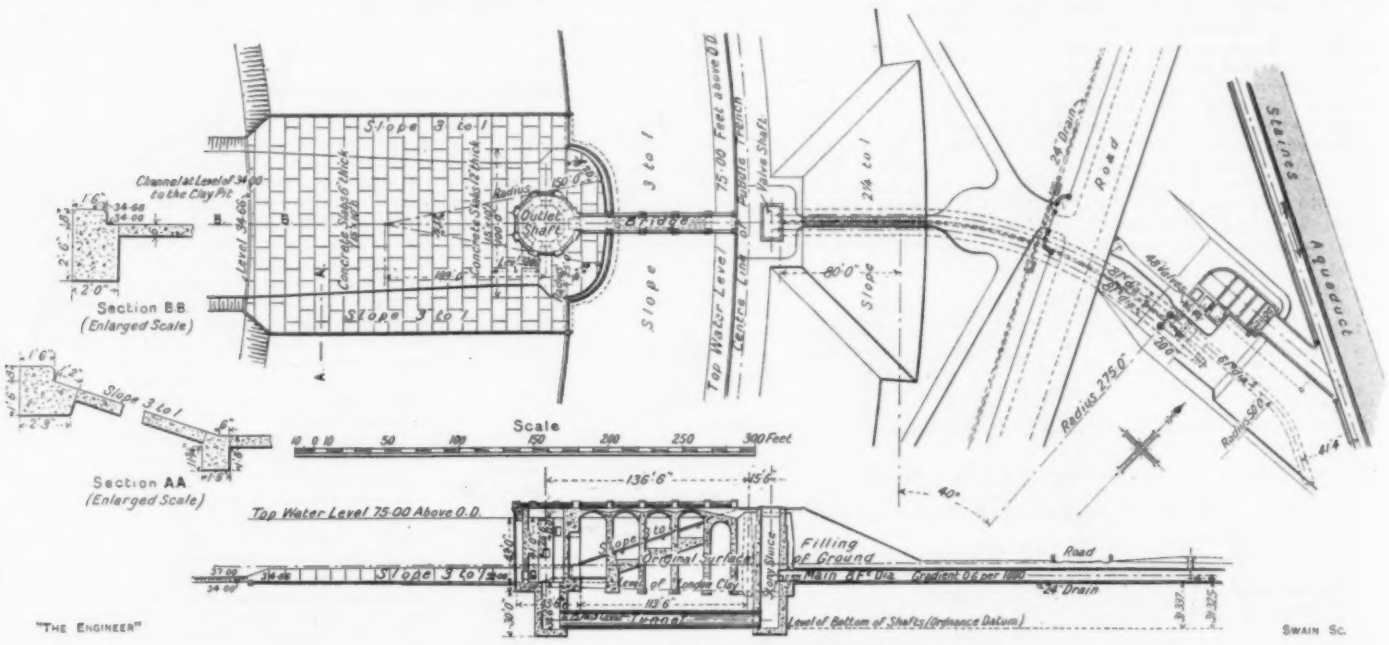


FIG. 20—PLAN AND SECTION OF OUTLET ARRANGEMENTS

layer of carefully graded ballast, two anchoring courses of concrete toe blocks of larger size, one at + 71.78 O.D. and the other at + 63.32 O.D., being used to help to keep the blocks in position. Below + 63.23 O.D. and down to level + 38.57 O.D., the slope is lined with concrete slabs, varying from 9ft. 6in. to 16ft. 8in. long by 5ft. 4½in. wide, and 6in. thick, three further courses of concrete toe blocks, the lowest being at + 38.57 O.D., being employed. The whole arrangement is well seen in Fig. 21, page 710, which is a view taken in the interior of the reservoir.

At the summit of the inner slope is a concrete coping, with reversed curvature, so as to break up any waves which may reach it. This coping, which is formed in two parts, upper and lower, and is being

and over it the outlet tower has been built. The latter is erected in a forebay, so that water reaches it on all sides. It is formed of mass concrete, and between levels + 60.0 O.D. and + 69.75 O.D. it is faced with concrete blocks, and above that with dressed Forest of Dean stone. As it is surrounded by water, it was necessary to have some means of approaching the tower from the reservoir embankment, and accordingly a four-arch concrete bridge carried on concrete piers has been provided. Each arch has a span of 18ft., and the upper portions of the piers are, like the tower, faced with Forest of Dean stone. The arcaded parapet of the bridge thus formed is of the same material. The forebay, which is 150ft. wide and extends into the reservoir for a distance of 200ft., is

shaft is entirely encased in clay puddle, which is tied into the London clay. Leading from it are two 8ft. diameter reinforced concrete pipes, with their axes at + 35.5 O.D., their inverts therefore being 2ft. 6in. below the cills of the lowest tier of sluices in the outlet tower. These two pipes are controlled by sluices which are operated from the level of the top of the embankment. They are taken in a straight line till the embankment is passed, and are then curved to pass under a roadway—see Fig. 20—just beyond which is a gauge basin, by which connection is to be made with the aqueduct from the Staines reservoirs, which passes close by. The works at and beyond this point are still in course of construction, and we propose to deal with them in a future issue.

Railway Matters.

A NEW rail motor, with an engine of 100 horse-power, built in the Newport workshops of the Victorian Railways, is being experimented with, with the idea of developing traffic on the country lines.

IN the course of a speech at a dinner of the Langbourn Ward Club, the Lord Mayor, on the 23rd inst., said that he was informed that in America all the tramways were to be taken up in the large towns and motor omnibuses substituted.

THE local authorities in the Pwllheli and Portmadoc district are to ask the London, Midland and Scottish Railway Company to double its single line between Carnarvon and Afonwen and the Great Western its line between Barmouth and Pwllheli.

IN April last the position of chief draughtsman to the chief mechanical engineer, Great Western Railway, became vacant by the death of Mr. O. E. F. Deverell. To fill the position Mr. Collett has promoted Mr. F. W. Hawksworth, the assistant chief draughtsman.

JUST after midnight on the 15th-16th instant, during a severe thunderstorm, a special passenger train on the Delaware, Lackawanna and Western Railroad was derailed near Rockport. Twenty-nine persons were killed outright and thirteen or more have since died from their injuries.

THE Taokow-Tsinghwachen Railway, in the Honan province of China, is to be extended to Tsinan, Shantung provincial capital, so as to connect the line with the Kiaochow-Tsinan and Tientsin–Pukow railways. The distance between Tsinan and Taokow is over 350 miles. Surveying is in progress in the neighbourhood of Tsinan.

WE noticed at Horsham, Southern Railway, recently what appears to be a good arrangement for illuminating the names of stations by means of the platform lamps. The latter are much smaller than the usual platform lamp and the name of the station in letters about 4in. high is suspended below and at a right angle thereto, so that the lamp lights up the name-board.

THE Southern Railway Company's station at Queen-street, Exeter, is to be improved at a cost of £40,000. There are to be four running lines through the station and a scissors crossing between the two up lines will allow a train to arrive at or depart from the up platform line, whilst another train occupies the other portion of that line. The up platform is to be so lengthened as to give a further 200 yards to the main line and 100 yards for the up bay.

THE Ministry of Transport's railway statistics for March have recently been issued as a Stationery Office publication. They show that, compared with the corresponding month of 1924, the number of passenger journeys at full fares were fewer by 11,138,849, but those at reduced fares increased by 370,085, the net result being a falling off of 10.2 per cent. The passenger receipts suffered a corresponding decrease of 2.3 per cent. Despite the reduction of 10 per cent. in the number of passengers carried, there was no decrease in the train mileage; actually, there was an increase of 0.6 per cent. The tonnage of goods fell by 7.1 per cent., wholly because of a decrease of 9.2 per cent. in the quantity of coal carried. Goods train receipts fell, though by only 3.8 per cent., and the reduction in goods train mileage was only 4.9 per cent. The ton-miles fell by 8.4 per cent., the average train load from 137¼ to 133½ tons, but in consequence of a slight improvement in the rate of movement the net ton-miles per engine-hour increased from 443¾ to 447¾.

IN our frequent discussions on the subject of railway accidents, we have urged that the true criterion is not the number of fatalities that occur during a year or a period, but the number of accidents. Viewed from the safety point of view, an accident, however small its consequence, is something to be avoided. The number of fatal accidents in a year is, in a sense, a fair gauge as to the safety of railway travel, and the railway interests are quite justified in pointing out that in 1901 and 1908 there were no fatal accidents; that in 1909, there was only one; and in 1916, 1919 and 1923 there were only three. But last year, too, there were only three, yet in two there were five passengers killed in each and fourteen in the third, and it was the worst year in the number of casualties since 1915. In 1923, by the way, there were only two accidents in which there were fatalities to passengers, whilst 1918 and 1920 had a similarly good record. That the number of accidents is not always a true test was shown in 1917, when there was only one, but in it twelve passengers were killed.

DERAILMENTS on railways differ from collisions in one respect—their causes are sometimes obscure. But the inspecting officers of railways are practically always able to put their finger on the cause of the most complex cases, or, at all events, to suggest that the mishap was due to one of two or three reasons, or to two or more combined causes. So successful have they been in this matter that the only derailment we remember during the last twenty-five years for which no cause could be assigned was at Wickham, Great Eastern Railway, on November 16th, 1905. We are led to make these comments because no clear cause can be found by Major Hall for the derailment on the Wye Valley line, Great Western Railway, mentioned in this column on March 13th. There was no excessive speed, defect in the track or obstruction on the line. The design of the engine—a 0–6–0 saddle tank—though "not perhaps ideal in some respects for anything but comparatively low speeds," has been shown by past experience to be "well suited to branch line work generally, and this class of traffic has been regularly operated by similar engines, of which there are some hundreds in service." There was, however, one apparently weak spot and that was in the clearance between the bottom of the axle-box and the horn tie. Experiments made after the accident gave a clearance of $1^{3}/_{16}$in. bare, which Major Hall considers is comparatively small. Oscillation might cause contact between the horn tie and axle-box, and once that was established there was, of course, a direct tendency for the tie to lift the wheel off the rail. Provision of a somewhat larger clearance was therefore suggested for the company's consideration.

Notes and Memoranda.

THE remuneration of journeymen brassfounders in China is from 12 dollars to 35 dollars a month, including food and lodging (1 dollar equals 2s. approximately).

THE Metropolitan Building in Toronto, which is twenty-one storeys high, was, according to the *Contract Record*, occupied four months after the erection of the steel work was started.

ACCORDING to the Minister of Agriculture, the estimated total capital cost of the beet sugar factories now being erected in this country is £1,836,000, of which £1,563,000, or 85 per cent., is being expended in this country.

ACCORDING to a report issued by the United States Geological Survey on the production of electricity by public utility power plants in 1924, the average amount of coal used for generating a kilowatt-hour is now 2.2 lb.

ON June 3rd the steamer Throckley started loading a coal cargo under No. 20 hoist of the Great Western Company at Newport, at 6.10 a.m., and by 9.50 p.m. on the same day had taken aboard a full cargo of 3845 tons 17 cwt. In view of the fact that only one appliance was used throughout the operations, this is considered a very good performance.

IF the purpose of a colliery is to get coal, and to have the largest possible proportion of the men in the pit occupied in extracting the coal, and the smallest possible proportion of the men doing anything else, then, according to the house journal of Messrs. Mavor and Coulson, for seams more than about 3ft. thick the longwall retreating system in one or other of its various methods of application merits very serious consideration.

RINGMER Windmill, not far from Hastings, which was built over 200 years ago, and was one of the outstanding features of the East Sussex landscape, has collapsed owing to the decay of its woodwork, and nothing is left standing save the huge oak centre post, dated 1700. Almost up to the last the windmill was used for grinding corn, two sweeps having been renewed in 1919 to provide a horse-power of about 30. Only one or two other similar mills still exist in East Sussex.

ACCORDING to the *Iron and Coal Trades Review*, a chimney, about 365ft. high, recently collapsed near Leipzig, killing eleven workmen and seriously injuring two more. The chimney had been built of cement concrete with reinforcement on the Nast system by the Nast Company, which specialises in this kind of construction and has built many chimneys on that system since 1910. It is stated, on the other hand, that on the occasion of the serious explosion at the Oppau works of the Badische Anilin und Sodafabrik the six Nast chimneys were left standing, while all others were destroyed by the force of the explosion.

THERE is now being produced in Canada, according to the *Contract Record*, a "poured-in-place-on-the-job" insulating material known as Insulex, which is a fireproof and vermin-proof gypsum product used for the purpose of preventing heat loss and for sound deadening. It is prepared in powder form and contains a "mineral yeast" which becomes active on the addition of water. As soon as this is done and the mixture stirred it begins to rise like a loaf of bread in the making. It is then poured in place and continues to rise after being poured. After the rising ceases the Insulex sets in twenty to thirty minutes. When it sets it contains innumerable air cells, which account for the high insulating efficiency of Insulex and earn for it the appellation "mineral cork."

IN the report of a formal investigation into the explosion of a boiler blow-down throat piece, which resulted in the death of a man, and was caused by unperceived wasting away of the metal, the following remarks are made concerning the value of such investigations:—"Perhaps we might mention that the means of preventing the explosion of boilers has been the result of experience, and that experience has often been gained by the investigation into the causes which have brought about the explosions. Engineers and inspectors have thus been able to concentrate their attention on the various parts of a boiler where defects have been demonstrated to be likely to occur affecting the safe working of boilers and endangering the lives of persons attending to them."

INCLUDED in the deck equipment of the Discovery, which is about to make a voyage of exploration in the South Pacific, there is a large trawling winch carrying 5000 fathoms of tapered warp on one reel and 1000 fathoms of trawl warp on the other. An auxiliary reel with 3500 fathoms of 6 mm. wire is driven from this winch. For vertical nets and hydrographic appliances there are four smaller reels, driven by three engines and all fitted with 4 mm. wire. Two of these reels carry 3500 fathoms of wire for deep observations and two carry 500 fathoms for observations at lesser depths. A Lucas sounding machine is installed with various attachments for the collection of bottom samples, and a dynamometer, accumulators, metre recorders, an electric centrifuge, and other subsidiary apparatus are provided.

TECHNICAL PAPER No. 12, which has just been issued by the Fuel Research Board, deals with the heating of rooms. One of the conclusions arrived at by the investigators is that for continuous heating in small rooms hot water radiators fed from a coke-fired boiler are the most economical method of heating; but as the size of the room increases open coke or coal fires become cheaper, especially when there are only a few people in the room. This is because, when air heating is employed, the whole of a room must be warmed, however few the occupants, whilst with radiation heating people can gather around a small fire, whatever the size of the room. For intermittent heating, say, when a room is actually in use only for four hours per day, hot water radiators remain the cheapest for small rooms with more than one or two occupants, but for larger rooms, especially when sparsely occupied, open coal or coke or gas fires become the cheapest. For longer periods of use the advantage of open fires over air heating is less pronounced; for shorter periods it is more pronounced.

Miscellanea.

THE famous Marconi wireless station at Clifden, in Ireland, is to be dismantled.

IT is proposed to expend some £100,000 on the construction of training walls for the river Ribble near Preston.

THE Government authorities of the Shansi province of China propose to erect about fifteen steam-electric power plants at a cost of some £20,000 each.

A SCHEME is being investigated for the development of electric power by means of the Lungmen Rapids of the Yellow River in the Honan Province of China.

THE Wolverhampton municipality proposes to extend the local sewage plant by two units, each capable of dealing with 1,000,000 gallons a day and costing £36,000 each.

A NEW coal seam has been discovered near Suiyuan, China, and is being exploited by means of native methods, but will be equipped with modern machinery if results justify the expenditure.

AN aerodrome, with an aviation school and a factory, is to be constructed outside the gates of Taiyuan, the capital of the Shansi province of China. Japanese engineers are to be employed.

THE provincial authorities of Shansi, China, propose to organise a number of refineries for extracting oil from shale. It is suggested that, at the outset, each factory should have an output of 6 tons of oil a day.

IN order to enable the United Steel Companies, Ltd., to keep their blast-furnaces going the Wellingborough Urban Council has reduced its royalties on ironstone taken from its land from 7d. to 3d. per ton.

THE big oil distillery at La Plata, Argentine, which is to handle 2000 tons of oil per day, is being rapidly completed. In addition, some ten tanks of 10,000 tons capacity each are being provided in different parts of the country.

A LARGE part of the Khyber ropeway, which was put up in 1919 on account of difficulties with the Afghans, is to be dismantled and sold. The ropeway is 19 miles long and has handled a maximum of 200 tons of goods a day.

THE total output of coal from the mines of Great Britain during the week which ended on June 6th was 2,784,700 tons, as compared with 4,682,900 tons for the previous week. The output for the corresponding week of 1924 was 5,120,200 tons.

THE Dominion House of Commons, Canada, has passed a resolution forbidding the export of hydro-electric power except on the basis of a yearly licence and no additional licences will be issued beyond those already granted, except with the concurrence of the provinces affected.

THE Argentine Minister of Public Works has signed a decree calling for the carrying out of water supply and drainage works in the districts of San Fernando, San Isidro, and Vicente Lopez, all near Buenos Aires. The expenditure is estimated to reach about 14,000,000 dollars.

THE Electricity Supply Company of Buenos Aires proposes to construct a power plant with a total capacity of 500,000 kilowatts, of which 400,000 kilowatts will constitute the normal output. The installation will really consist of five stations of 100,000 kilowatts each, which will be able to work either separately or in combination. Pulverised coal is to be used as fuel.

ON June 19th the thirteenth German destroyer S 32 was raised at Scapa Flow by Cox and Danks, Ltd. This thirteenth ship took a matter of nine days to lift, which is twice as long as each of its twelve forerunners. A gale persisted almost from the time the floating docks moved out and added difficulties to the operations. It is hoped to lift the fourteenth vessel before the end of this month, making three salvages in one month.

THE figures as to the enormous amount of gas used at Wembley last year—40,000,000,000 British thermal units when calculated on a heat basis—are likely to be exceeded this year, as several new buffets, cafés and restaurants have been provided, in all of which gas will supply practically the whole of the heat required for catering purposes. This year, too, gas is being used for various purposes in almost every Colonial exhibit, as well as by a large number of exhibitors in the industrial and other palaces.

A SMALL but interesting exhibition has been arranged, and is now on view at the Science Museum, South Kensington, commemorating the centenary of the discovery of benzene by Faraday. Amongst the exhibits are two original specimens of benzene, prepared and labelled by Faraday, which were bequeathed to the Museum in 1911 by Mr. H. L. Barnard. The original cabinet in which Faraday stored the specimens of benzene is also on view. Other interesting exhibits show the importance of benzene to the synthetic dye industry and illustrate the distillation of coal tar, from which benzene is obtained on a commercial scale.

IN connection with the proposal to construct a tunnel under the Thames between Dartford and Purfleet, Lieut.-Colonel Moore-Brabazon stated in Parliament this week that the matter had been under the consideration of the London Traffic Advisory Committee, which had made an inspection of the site proposed. He was informed that the Committee, while it considered the scheme a desirable one, took the view that on traffic grounds other important schemes which it now had under consideration should take priority. Detailed consideration of the financial aspects of the proposal had therefore been postponed.

THE Stepney Borough Council recently instructed its standing committees to consider and report upon the practicability of substituting electricity for gas for lighting and heating purposes in the buildings under their control. The Works Committee reports that it has given instructions for the substitution of electric lighting for gas at three depôts, and that it is proceeding as rapidly as possible with the substitution of electricity for gas in street lighting. Other committees report that practically all their buildings are already electrically lighted. The General Purposes, Staff and Education Committee and the Public Health Committee do not consider that the replacement of gas by electricity for heating purposes can be justified,

THE LITTLETON—QUEEN MARY—RESERVOIR OF THE METROPOLITAN WATER BOARD

MR. HENRY E. STILGOE, M. Inst. C.E., LONDON, ENGINEER

(*For description see page 705*)

FIG. 21—VIEW IN THE RESERVOIR LOOKING TOWARDS THE INLET

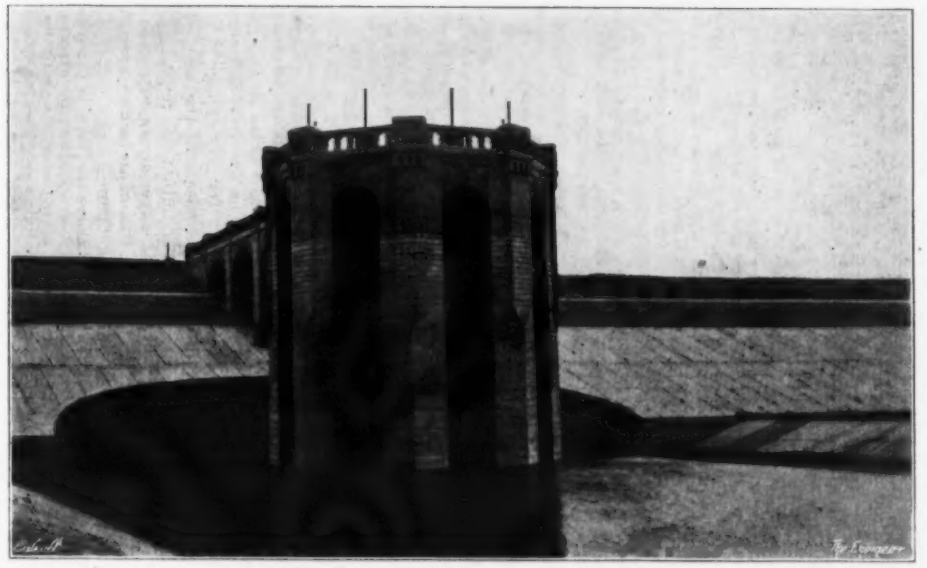


FIG. 22—THE OUTLET TOWER FROM THE RESERVOIR

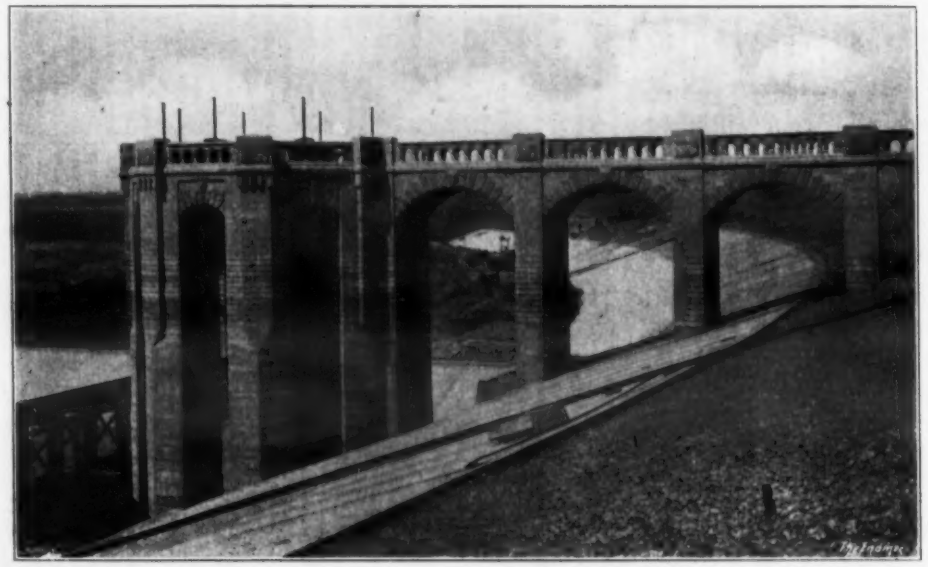


FIG. 23—THE OUTLET TOWER AND APPROACH BRIDGE

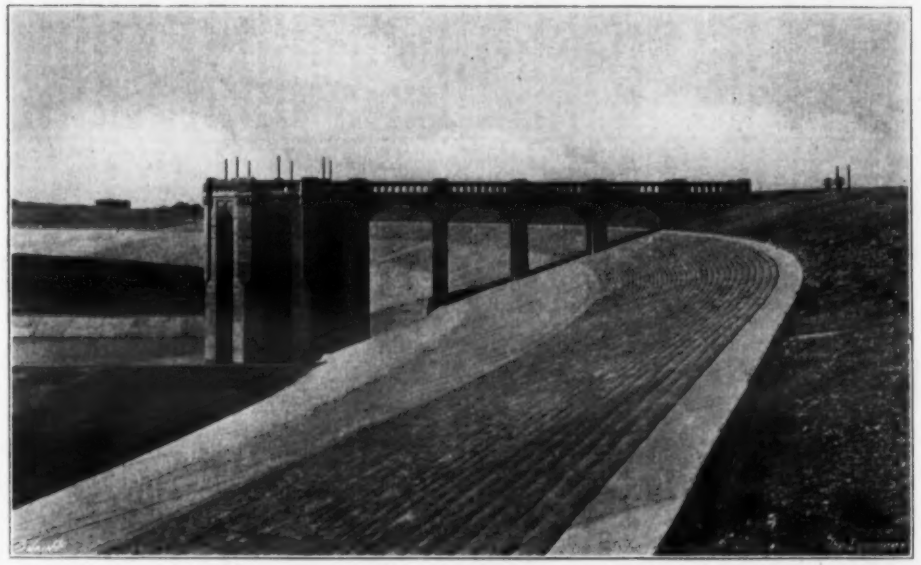


FIG. 24—FOREBAY, OUTLET TOWER, AND COMPLETED PITCHING

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TWO-PAGE SUPPLEMENT—WATERLOO TEMPORARY BRIDGE—NAVIGATION SPAN. SIXTEEN-PAGE SUPPLEMENT—THE METALLURGIST.

The Metallurgist

THE JUNE NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

THE ENGINEER.

JUNE 26, 1925.

Locomotive Valve Travel.

IN the echoes of the controversy which followed the most important and decisive trials of steam locomotives which have ever taken place—the Rainhill Trials of 1829—a story obtained currency that one of the competitors, when asked to explain a remarkable exhibition of power by his engine, replied to the effect that it was due to "a little thing inside the chimney." Not many weeks ago, when watching the imposing passage of the London and North-Eastern Railway "Pacific" engine over the Great Western Railway, one of that company's enginemen, when asked how he could expect the smaller engines of his line to compete, made much the same reply—that there was something inside the smoke-box which would make all the difference. That, at least, was the gist of his remark, and the foundation of the perfect confidence with which he watched his rival's performance. In the discussion on these trials now taking place in our columns those of our readers who have called attention to the unusually long valve travel of the Great Western engine have without doubt hit upon a "little something" which has been one of the most important factors contributing to its remarkable success.

When we come to study the question, and inquire how it is that by so simple a method as increasing the lap of the valve, and consequently its travel, such results can be obtained, we may well be astonished that there was in general so little practical appreciation of the underlying theory, in spite of the fact that the practice has been standard on the Great Western Railway for many years, and that attention has been more than once drawn to its beneficial effects by Mr. Churchward, who introduced it. In the discussion on his paper on "Large Locomotive Boilers" before the Institution of Mechanical Engineers in 1906, Mr. Churchward explained both his reasons for and the results of a policy for which the Great Western Railway is still indebted to him and to those who have pursued it. But the whole theory was stated before the Institution of Civil Engineers by Edward Woods, of the Liverpool and Manchester Railway, long ago, as the result of experiments carried out in 1838. Up till that period the slide valves of locomotives were made to all intent and purpose without lap, though in practice a lap of one-sixteenth or one-eighth of an inch was provided at each steam edge, to ensure that as the result of expansion or errors in workmanship or marking off of the valves and cylinder ports, both steam ports should not be open to steam at the same time. The original theory postulated that the edges of the valve and the edges of the ports should be line in line, so that the valve opened to steam at the one end and to exhaust at the other at the same moment. The link motion had not been developed at that time, and there was one cut-off only for each gear. It is easy now to see what the choking effect must have been at high speeds with a valve which opened to exhaust only at the moment when the piston reached the end of its stroke, and the early locomotive engineers soon realised, though they were puzzled to account for, what they described as a "loss of power at high speeds." At one time piston speed was blamed, and the stroke was shortened, with dire effect on the consumption of fuel, for, to quote Woods' own words, "the piston had to contend with a resistance altogether illegitimate, a resistance which in many cases, and especially at high speeds, has been nearly equal to all the other resistances put together. In the year 1838 the extent of the disease was first suspected and a remedy attempted. It had before been observed that the giving of an engine '*lead*' tended to improve its speed when travelling, already at a high speed and with a light load. The circumstance was attributed to the opening of the steam port being wide at the time of commencing the stroke, thereby increasing the facility for the entrance of steam in following up the piston. Its true explanation was found to be the earlier release of the waste steam and consequent diminution of resistance." Woods then described experiments with laps increasing from three-eighths of an inch to the one inch with which all his company's engines were eventually fitted, new cylinders being provided in which "great care was, of course, taken to enlarge the area of the passages of exhaustion. . . . Every step towards increasing the lap was then found to conduce to the good working of the engine. The waste steam was no longer choked up in the cylinder; its prejudicial resistance was removed, and, in consequence, a much less quantity of steam and fuel sufficed to do the same useful work. As a further consequence, the area of the blast pipe could be enlarged without risk of a deficiency of steam, and the coke was no longer chafed by the violence of the draft." Woods states that a reduction in the gross consumption per mile from an average of 49 lb. to 40 lb., with a three-eighth inch lap, was secured; 32.4 lb. with three-quarter inch; and 28.6 lb. with one inch lap; but he was unaware that part of this saving was due to the more expansive working, and, curiously enough, he regarded the earlier cut-off as a source of power loss, only compensated by the much greater gain on account of the freer exhaust. In regard to the exhaust, his theory was as sound then as it is to-day, and capable of further application, and we may well inquire why, during the remainder of the nineteenth century, there was nothing like a proportionate increase in laps and valve travels, in spite of ever-increasing demands on the power of locomotives. It has been suggested in a recent discussion on "Locomotive Valve Gear" that valve arrangements and proportions have, until recent years, been quite adequate to deal with the steam which could be supplied to them. Indeed, there have been good reasons in the past for keeping the travel of valves to a minimum, for up to the end of the nineteenth century flat valves, driven by excentrics and often unbalanced, or only partly balanced, were generally employed in this country. Every increase of the lap meant a proportionate increase of the area under direct pressure, and of the diameter of the excentric, and it directly increased the work to be done on the valve. With piston valves these conditions have been profoundly modified, and the use of Walschaerts gear, at least for outside cylinders, has eliminated the excentric. It is, however, to be remarked that the long-stroke piston valves of certain classes on the Great Western Railway are driven by the Stephenson link motion, so that we may reasonably suppose that the governing factor is to be found rather in the use of piston valves than in the type of valve gear. The use of the piston valve has also made it possible to adopt a straight port, or more correctly, to return to the use of such ports, for they were tried by Robert Stephenson in 1832, as may be seen from some remarkable drawings on loan exhibition at the Science Museum, South Kensington. There, also, are drawings which show that double slide valves

were used at the same period, and indeed earlier, for the obvious purpose of obtaining shorter steam ports. But it is clear that the area of valve under pressure was doubled by this arrangement, and it would seem that double valves were abandoned on that account; but the fact remains on record that as soon as locomotives began to run at speeds of more than twelve miles an hour, the need for such expedients as we have described became evident to locomotive engineers, and hence we find them making such notes as "the curves in the steam passages to be kept full, according to the drawings." A few years later Brunel, when ordering locomotives for the Great Western Railway, urged upon the makers the need for ample and easy steam passages with reduced cylinder clearances. It is worth observing, in passing, that the cylinder design of the Great Western Railway is remarkable to-day for a clearance of but one-quarter of an inch between cover and piston. Returning to the records of the past, we find evidences of ceaseless endeavour in the 'thirties and 'forties of the last century to enlarge the blast nozzle. Robert Stephenson stated that at one time designers had aimed at an area equal to that of the steam pipe. So we are led, in conclusion, to consider in its logical sequence the last of the several factors which have contributed to the success of modern Great Western practice—the "little thing in the chimney" which provides final escape for the steam which has been assisted so much by the arrangement of the valve and its passages—a special blast pipe nozzle, adjusted to lift at a predetermined pressure, which automatically provides a larger area when the engine is working at late cut-offs under heavy load.

While these factors have no doubt contributed to the excellent performance of the Pendennis Castle and its prototype, there may be others in the arrangement of the engine and drive which have helped; but the most important factor is almost certainly in the extended and perfectly logical application of a principle which was long ago accepted as fundamental to good locomotive design, but of which the application was limited by practical difficulties which have since been overcome. This journal has always devoted much space to the study of early locomotive history, and recent events seem to justify the view that such study can, even now, suggest, or at least confirm, certain lines on which the modern locomotive may be improved.

Electric Railway Standardisation.

AT the annual meeting of the American Institute of Electrical Engineers, held on the 15th of last month, several addresses were delivered on railway electrification, the purpose of the meeting, according to the Institute's *Journal*, being to make it known that the manufacturers of electrical plant, applicable to railways, are now prepared to supply any equipment that may be decided upon as a desirable standard. For many years the divergence of engineering opinion among American manufacturers has prevented a free forward movement in railway electrification in America and elsewhere, and it is a matter of satisfaction to discover that the difficulties in this direction have been removed. Standardisation of electric transport equipment is now regarded as desirable for reasons which are pretty obvious, for as Mr. W. S. Murray explained in his paper on "Super-power," read at the World Power Conference last year, out of six major railway electrification schemes in the United States not one engine of any one of them can be operated on the lines of the other five. The time has therefore arrived when the practice of installing equipment without regard to interchangeability must be discontinued, and when some standard system must be chosen. Standardisation, said Mr. Herbert Hoover, in his address delivered at the meeting to which we have referred, would facilitate the development of a co-ordinated electrified transport system which would give maximum service with the least utilisation of capital and labour; it would also ensure interchangeability of equipment between different railways, with a consequent better utilisation of locomotives and equipment, a lower cost of maintenance and a reduction in repair stocks, whilst uniformity of voltages, frequency, and other electrical characteristics would permit of a much more effective application of electric power. Development of interconnected central distribution systems, he added, made possible an efficient utilisation of fuel and water resources and provided a pool of energy for electric transportation.

Although the speakers at this annual meeting were agreed upon the necessity of standardisation, they did not say what system they proposed to standardise; but anyone who is familiar with present American tendencies can make a pretty shrewd guess at that which will ultimately be adopted. The exceptionally large and powerful locomotives that are now being built for certain American lines draw from the system more current than can be conveniently collected at ordinary direct-current voltages, and it seems that if standardisation is to come into force, alternating-current collection will be inevitable. Moreover, Mr. E. M. Herr, president of the Westinghouse Electric and Manufacturing Company, remarked in the course of his address that the recent development of an electric locomotive, which in connection with a high-tension alternating-current contact wire permitted the choice on the locomotive of either three-phase or direct-current motors, was a very long step towards a standard system, or at least a uniform distribution system, which would enable railways freely to interchange traffic with locomotives of several different kinds. The adoption of this system should eliminate all antagonism between the two largest American electrical manufacturing concerns, which in the past have held different views regarding the question of whether electric trains should be propelled by direct or alternating current motors. Fifty-cycle distribution for industrial, domestic and railway purposes with a high pressure on the railway contact wire is, in our opinion, a thing well worth striving for, especially in a country like America, where exceptionally powerful locomotives are being put into operation. In Hungary, it is to be remembered, this scheme of collecting high-pressure single-phase 50-cycle current from a single overhead conductor has been chosen because it is believed that it is a more economical and better system than any of those commonly employed. But whereas in America some of the recently built locomotives that collect 50-cycle current are equipped with three-phase induction motors and others with direct-current motors as on the Ironton Railway, the Hungarian scheme will only involve the use of induction motors.

Some American technical writers appear to imagine that the practice of converting single-phase alternating current into direct current by means of motor generators on locomotives is new, whereas as a matter of fact it is very old, the method having been suggested many years ago by two English engineers, Messrs. Mordey and Jenkins. The idea never materialised because the equipment was considered to be too heavy; but since the development of 3000-volt locomotives, with motor generators for working auxiliaries and for lighting, it has apparently been found that conversion of all the current is justifiable, especially when it is remembered that, if desired, current can be collected at pressures up to 22,000 volts, which, of course, also applies to locomotives which carry phase converters. We doubt, however, if these "alternating-direct-current" locomotives with motor generators will survive, for their efficiency cannot be very good, and it is not improbable that in cases where regeneration is of no importance the motor generator will ultimately be replaced by some form of static rectifier. In any case the idea of supplying electric trains with 50-cycle single-phase current has, in our opinion, much to be said for it, and assuming that it is decided to standardise the system in America and that the Hungarian experiments prove a success, it is to be hoped that British engineers will at least give the system careful consideration before electrifying our main lines in accordance with the proposals that have been made.

The Doors of Railway Trains.

SIDEWAYS sliding doors, such as those used on the London Underground Railways, possess several advantages, among which not the least is the fact that they cannot be swung open by thoughtless passengers about to alight, to the danger of their fellows on the platforms waiting to board. They have, however, several disadvantages. During the period of deceleration great effort is required to open them, and conversely during the period of acceleration they have a tendency to open or to remain open, whilst some of them have a disagreeable way of closing themselves suddenly, which conjures up pictures of broken fingers. Moreover, the very fact that no material mishap can occur if a train is allowed to depart with its doors open renders those responsible for closing them less alert in the performance of their duty than they would have to be were they dealing with side-hung doors. It is no uncommon experience on the London Metropolitan and District Railways to find oneself in a train with a door open, sometimes the door on the non-platform side, and sometimes even two doors open directly opposite each other. At times accidents happen by passengers falling out or by their mistaking an open door on the non-platform side for the other one. Such an accident occurred the other day at Farringdon-street Station, and on Monday in Parliament, Mr. Thorne questioned the Minister of Transport about it. The Parliamentary Secretary, replying, stated that he was in correspondence with the railway company on the matter, and that the subject of trains running with open doors would be closely followed. In this connection it seems to us that the travelling public is chiefly to be blamed. We stand in admiration of the dexterous efforts of the station staffs of both underground and surface railways to shut the doors of a departing train, yet feel that they should not be needed. A little consideration for the staff on the part of passengers entering or alighting from a train would completely avoid all danger. As it is, mishaps, sometimes fatal, are invited not only to the staff but to the passengers themselves. Nothing is more striking than the difference of custom in this respect between English and Scottish railways. In Scotland it is tacitly and universally recognised as the passenger's duty to shut the doors. In England it seems to be anybody's but his. But perhaps the average Scot knows his R.L.S. better than the average Englishman, and keeps his eye on the main chance when he recalls Stevenson's statement that the dexterity with which Thoreau shut a railway carriage window led to the immediate offer of a job. The step from window to door is but a short one.

The International Railway Congress.

No. IV.*

THE formal opening of the Congress by the Duke of York is referred to in a note on our Journal page. The actual business commenced on Tuesday morning, when the delegates met in the sections. Our present notice refers only to the work done in Section II., which deals with questions relating to locomotives and rolling stock.

The chair in Section II. was taken by M. Weiss, of the Swiss Federal Railways. One of the vice-presidents was Mr. H. N. Gresley, whose assistant, Mr. O. Bulleid, was one of the secretaries. A summary of the reports on fuel and its combustion having been read, M. P. J. Diniz, of the Portuguese National Railways, said that his line had used virtual ton-kilometre statistics since the beginning of the present year, using a coefficient of 1.2 on lines of easy gradients and 1.4 to 1.6 in hilly districts. That had led to a reduction in the consumption of fuel by 2 or 3 grammes per ton-kilometre. M. G. Bianchi remarked that the virtual ton-kilometre had been used in Italy for at least twenty years. The coefficient varied according to the section of line, the average being about 1.35, and took account of gradients and curves, but not speed. Sir Henry Fowler said that that was a subject that was mentioned in the discussions at the Rome Congress. He thought information would be useful as to what allowance should be made for straight and level roads, where speed became an important factor. There was no information available as to the effect of curves on speed. He would like to know if it was used in Switzerland. To this question the chairman replied in the negative. M. A. Pawlowski observed that the Polish railways were studying the use of the virtual ton-kilometre statistics.

On the subject of liquid fuel, M. Cantuniari, of the Rumanian State Railways, said that they used oil alone for five years, but the results were not satisfactory. It was found that the fire-boxes were damaged, so the grates were altered, and a mixture of oil and lignite was used. The blast pipes were found to be too large, and were also altered. There was still no satisfactory burner. He preferred an outside type of burner with a settled ratio of oil and steam. M. B. Nobili reported that three years' tests on the Italian State Railways showed better results with oil alone than with oil and coal mixed. The burners, up to five in number, were, however, fixed at the back of the box. Answering a question put to him at this point, he said that he found that the temperature could be kept within reasonable limits by varying the number of burners in use.

Colonel F. R. Collins said, on the question of rocking grates, that as the coal used in South Africa had a high ash content, they used rocking grates. Mr. E. W. Head, of the Ceylon Government Railways, had a large number of both types of grates. He had, of late, been using an inferior quality of coal, which gave a larger proportion of clinker, and had found rocking grates useful.

On Tuesday afternoon the section discussed the

* No. III. appeared June 19th.

question of mechanical stokers, and the conversation was opened by Mr. D. F. Crawford, formerly superintendent of motive power, Pennsylvania Railroad, and now vice-president of the Locomotive Stoker Company, who said that in the United States there were 8000 locomotives provided with mechanical stokers. The work was commenced in 1912, but the larger proportion had been fitted since 1918. About 15 per cent. of the total number of engines had mechanical stokers, and 90 per cent. of that proportion were of 60,000 lb. tractive effort and over. It was probably safe to say that all engines of that size, except those oil-fired, were fitted. Its provision avoided the necessity for a second fireman, and so saved labour, whilst the temperature in the fire-box was higher. Engines could now be worked over two divisions without the fire being cleaned, and in one case over three divisions. It had been found that 15 per cent. greater load could be hauled than with hand firing. In hot countries the mechanical stoker was necessary because of the less physical capabilities of the fireman. Sir Henry Fowler asked what was the effect of the hotter fire on superheat and on smoke, whilst Mr. Gresley wanted to know what was considered to be the limit that could be hand-fired. Mr. Crawford replied that the mechanical stoker put on a small quantity of coal, and so there was little smoke. The superheat was increased. The limit with hand-firing was, he said, the amount the fireman would handle, and not what he could. He thought the figure might be put at 4000 lb. per hour, except in the Southern States, where the limit might be 3000 lb. per hour.

The subject of lubrication was then considered, when Mr. R. E. L. Maunsell said that the importance of the dissipation of heat between the journal and the bearing had not been sufficiently considered. The axle-boxes on British railways were open-fronted and cast in one piece, and the top could not be machined. He had carried out some experiments by milling the ends of the boxes so as to give proper contact between the brass sheet and the box. Two boxes on a carriage were so treated, and two were not machined. In each a thermometer was inserted, and after three months' tests it was found that the temperature in the former was 30 deg. lower than in the other. M. P. Lancrenon, of the French Northern, gave a good report of the isothermos box on the tenders of locomotives and on carriages, which opinions were confirmed by M. Poncet, of the French Eastern.

Proceeding to the question of ball or roller bearings, M. M. Lacoin, of the Paris–Orleans, said that, contrary to what was expected, they were of no practical advantage in the starting of trains, and would be of no service at all in fast freight trains. The cost was too high. Mr. V. Ahlberg, of one of the Swedish private lines, considered that roller bearings were good, but expensive. The journal was liable to be hammered at the rail joints, and he thought that further investigation was required. Mr. R. W. Reid, of the London, Midland and Scottish, alluded to the tests he had made with Sir Henry Fowler. He had come to the conclusion that they were of very little advantage, except, possibly, at starting. He could not support Mr. Maunsell's opinion as to machining the top of axle-boxes. The amount of temperature depended upon the degree of finish put on the journal. His company ground the journal. Burnishing had been tried against grinding, and the temperature was lower with the latter. Before the Midland Company was incorporated in its present group, the practice was only to oil goods wagons once in three months; now it was every month. The latter was, he thought, too frequent, as it led to a greater waste of oil, and did not reduce the number of hot boxes. It was, he considered, desirable to adopt either pad or waste lubrication. Oil of a high viscosity could be used for pad lubrication, but not with waste.

Mr. Gresley said that he had had the best results with bearings in which a tin base was used for the white metal. The only difficulty he had experienced with mechanical lubrication was to get the pipes to stand the vibration. Engines engaged in shunting and those that were stationary for long periods showed a considerable saving in oil. He would like to hear the experience in America of grease lubrication. To that question Mr. Wallis, of the Pennsylvania, replied that its use was universal.

Wednesday morning was devoted to the recommendations to be submitted by the section to the general meeting of the Congress. These usually follow the summary submitted to the section by one of the reporters. That relating to fuel was put forward by M. Chenu. The question of the virtual ton-kilometre was again discussed at length, and all that was agreed to was the expression of opinion that it would seem to be the best unit of comparison. It was said of oil fuel that its advantages were:—(*a*) A reduction in consumption of fuel when the engine is standing; (*b*) an increase in the power of the locomotive; (*c*) less work for the fireman; (*d*) allows the quantity of the fuel to be varied; (*e*) more easily handled; and (*f*) can be burnt with little smoke.

It was proposed to say, in relation to rocking grates, that for long distance runs it was proposed to use rocking grates instead of fixed grates. That was objected to by M. Vallantin, P.L.M. Railway, who said he had 800 rocking grates in use, but was going to take them all out as they increased the consumption of coal. Mr. G. G. Elliott remarked that, in the early days, the South African Railways used Welsh coal. Now they burnt home-produced coal, which was not as good, and so rocking grates had to be employed. Eventually, the reference to rocking grates was withdrawn from the recommendations.

A long discussion then ensued on the question of mechanical stokers, as to which it was proposed to say, *inter alia*, that they could be justified where the coal consumption was 1500 kilos. to 2000 kilos. per hour. M. Duchatel, of the Eastern of France, M. Bachellery, of the Midi, and M. Vallantin, of the P.L.M., opposed this. The last-named said that it might lead to a demand of the men's unions that mechanical stokers should be provided when the coal to be handled reached a certain figure. It was also proposed to say that mechanical stokers enabled a hotter and more uniform temperature to be maintained. Mr. Gresley objected to that suggestion as being too definite, and it was eventually agreed to record simply that where the quantity of coal is too great to be handled by hand, mechanical stokers are an advantage.

Spark arresters proved to be another thorny subject. Mr. Gresley said that there were many in use on a section of his line, but that there were more fires there than on those sections where they were not used, and he proposed to take them out. Sir Henry Fowler agreed with Mr. Gresley; his experience was that, to prevent sparks, was to make an inefficient engine. Colonel Collins remarked that in some countries, *e.g.*, South Africa, spark arresters were required by law. They would break up the cinders so that the danger of the sparks was minimised. M. A. Politis, of the Greek Government Railway, alluded to spark arresters as a factor in insurance. The result of the discussion was rather amusing—it records that spark arresters are used and what they are made of.

The suggested recommendations as to lubrication were then submitted by Sir Henry Fowler. Very few changes were made. There remains, however, for decision in the general meeting, the point as to whether or not it should be said that white metals having a lead base should be recommended. Mr. Gresley and Colonel Collins were opposed to this, and preferred a tin base, whilst Sir Henry Fowler supported lead.

Dry-Weather Flows.

By ALFRED A. BARNES, M. Inst. C.E.

ALTHOUGH a few local showers may have prevented certain districts from registering an "absolute drought," yet in many places the official definition of "*more than fourteen consecutive days without a rain day*" will have been complied with during the present month. The drought has been accompanied by intense heat over the early part of this period, the thermometer reaching a maximum temperature of 88 deg. Fah. in the shade in certain instances, and although the month of May was distinctly wetter than normal over England as a whole, yet the discharges of rivers have fallen off very rapidly.

Up to the moment of writing (June 22nd) there are no signs as yet of a general break-up of the drought, which has now reached its twentieth day in many places, and this article is written as a reminder to engineers not to miss the opportunity of measuring the dry-weather flows of streams. The profession is hardly be dwelt upon, and it is hoped therefore that this reminder will not be out of place.

There are, of course, many methods by which the flow can be gauged, but a distinction must always be drawn between gaugings taken on reservoired and unreservoired areas. The latter are the more valuable records, but in the event of their not being obtainable a certain correction should always be applied when one or more reservoirs exist on the drainage area. An approximate correction, which will be found of service during summer months, is to add to the flow a quantity of ½ cubic foot per second for each 100 acres of water area on the date of gauging. This figure is arrived at by assuming an evaporation of practically ¼in. per day off the water area of the reservoir. The bulk of the yield each day can in these reservoired cases only be obtained by subtracting the loss in storage from the measured quantity sent out from the reservoir, but as the actual volumes stored at the various contours are always somewhat uncertain it will be realised that the yield each day can only be regarded as approximate in these cases. If, however, a curve be plotted from day to day, fairly satisfactory results can be obtained with the correction mentioned above.

Whether the gaugings be taken on reservoired or unreservoired areas, their interest will always lie in the rate of change from day to day as shown by the curve, and whenever possible, not only should the minimum flow on one day be recorded, but also the average flow per day during the lowest consecutive seven, fourteen, and twenty-eight days. If recording apparatus be not used the readings should be taken at the same hour each day, and the actual drainage area to the point of measurement should always be obtained from maps as accurately as possible. It is remarkable how closely the figures will be found to agree over widely separated and diversified drainage areas when reduced to a common unit in cubic feet per second per 1000 acres. The flow will be found to have no relation whatever to the average rainfall of the district, and for this reason it has always seemed a mistake that the quantity of compensation water should ever be based upon the rainfall.

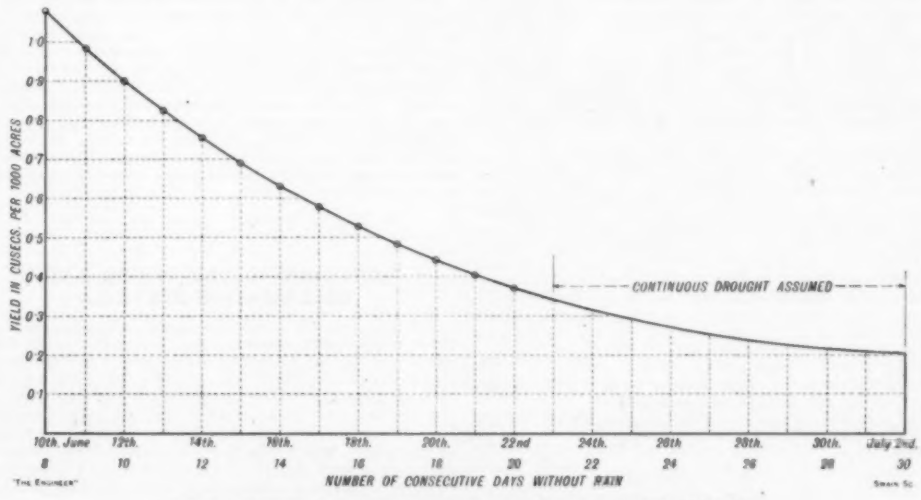
A rough indication of the rate of flow to be expected from any drainage area in the British Isles during the days of drought is given on the accompanying curve, the figures from which it has been plotted being as follows:—

Table of Dry-weather Flows.

Consecutive days without rain	Date, 1925.	Discharge, cusecs per 1000 acres.
8	June 10th	1.080
9	„ 11th	0.984
10	„ 12th	0.900
11	„ 13th	0.823
12	„ 14th	0.753
13	„ 15th	0.689
14	„ 16th	0.630
15	„ 17th	0.576
16	„ 18th	0.527
17	„ 19th	0.482
18	„ 20th	0.441
19	„ 21st	0.404
20	„ 22nd	0.370
*21	„ 23rd	0.340
*22	„ 24th	0.313
*23	„ 25th	0.290
*24	„ 26th	0.269
*25	„ 27th	0.251
*26	„ 28th	0.236
*27	„ 29th	0.223
*28	„ 30th	0.213
*29	July 1st	0.208
*30	„ 2nd	0.205

* Continuous drought assumed.

It can be stated with a fair degree of certainty



CURVE SHOWING DIMINUTION OF RATE OF FLOW DURING DROUGHT

not any too well provided with data under this head, and we fall far behind the Canadian and American engineers in this respect. Their statistics are of very little service to us owing to the different conditions of climate, and it is therefore important that information should be collected here on every possible occasion. The usefulness of such measurements in improving our knowledge of yields and in helping to arrive at equitable quantities of compensation water need that if the yield does not approximate roughly to this ideal curve either the geological drainage area does not conform to the physical drainage area within the watershed limits or there are certain outstanding and unusual conditions obtaining on the gathering ground. Hence the need of more and more gaugings to determine the merits of respective sources of supply. Some drainage areas may consist of more or less impervious rocks, others may have peat bogs

scattered about them in places, while a third class may have a large saturated gravelly bed or an area of decomposed granite which would naturally give up its water more steadily, but in every case there is very little difference observable in the shape of the yield curve in a drought. The larger the drainage area the more likely are the conflicting conditions to cancel each other, so that the curve given above will be found more nearly correct quantitatively for these larger areas.

It is probable that on this, the twentieth, day of drought (June 22nd) there are not many streams in England yielding at the rate of more than ½ cusec per 1000 acres of their true drainage area, and in many cases the flow will be found to be as low as 0.35 cusecs per 1000 acres already.

Obituary.

HUBERT L. TERRY.

WE have to announce with regret the death of Mr. Hubert L. Terry, who was for many years a valued contributor to THE ENGINEER on metallurgical and chemical matters.

Mr. Terry, who was born on May 8th, 1865, was the second son of the late Rev. Michael Terry, for many years vicar of Awsworth, Notts. He was educated at Rossall School, and afterwards studied chemistry at Owens College, Manchester. He was for some time analyst to Messrs. Charles Mackintosh and Co., of Manchester, and afterwards started business on his own account as an analyst, being chiefly interested in rubber. His knowledge of the minerals of this country was very extensive, and his opinion on chemical questions was held in high regard. He was a Fellow of the Institute of Chemistry and an Associate of the Institution of Mining and Metallurgy.

United States Patents.

THE report of the Commissioner of Patents to Congress for the year ended December 31st, 1924, has recently become available through the "Official Gazette" of the United States Patent Office. As usual, it contains matter interesting to inventors generally because, among other things, it indicates the amount of patenting which takes place in the United States in respect of inventions originating abroad.

According to the Commissioner, the year 1924 was one of unprecedented progress and gains in the Patent Office. The number of applications received amounted to 101,134, or 2738 more than in 1923. Through rearrangements, reorganisation, and expedition, notwithstanding the increased number of applications received, at the end of the year an actual reduction of nearly 12,000 applications awaiting official action is notified. This is some consolation to inventors who know that at the present time it is customary to wait for months before taking action on their applications.

The total number of patent, design and trade-mark applications finally allowed was over 9000 more than in the preceding year, the total number of issued patents, designs and trade-marks showing an actual increased output over 1923 of more than 5000. As compared with a year before, instead of three divisions being less than nine months in arrears, there were nineteen divisions in that condition. At the beginning of 1924 twenty divisions were over eight months behind, whereas now all divisions are under eight months in arrears. The average time an applicant now awaits an official action has been reduced to four and a half months for new work and between three and four months for old work.

The total fees received by the Patent Office were materially increased because of the addition to the filing fees made by Congress, the result being that total receipts during the year were larger than ever before in the history of the Patent Office, amounting to more than 3,000,000 dollars.

The office as a whole has been reorganised, and an important point, which, however, is of not material assistance to inventors in this country, is that the public search room is being reorganised and new steel stacks provided to contain patents for the assistance of searching. It is generally recognised that the United States Patent Office tends to reduce the work of searchers as much as possible. As is the case all over the world, the general trend of patent work is in an upward direction, one of the results as far as the United States is concerned being that the present patent building is considered unsuitable for the present needs of the Patent Office, especially for the peculiar needs of a modern patent office.

Fresh legislation is contemplated to deal with certain matters, one to follow British practice.

The following statistics of the business of the United States Patent Office in 1924 are of interest:—

	Dollars.
Fees for patent applications for inventions	1,529,983
Fees for re-issues	7,990
Fees for final fees	849,050
Fees for appeals	30,360
Fees for copies of patents and general services	463,641
Fees for sale of "Official Gazette" and filing publications	27,435

These, with other receipts, make a gross total of 3,176,622 dollars.

Notwithstanding this large figure, the total expenditure was in excess of the total gross receipts, for it amounted to 3,561,395 dollars. On the other hand, there was a total net surplus in the United States Treasury at the beginning of 1924 of over 8,000,000 dollars, so that with the deficit for the year 1924 the total net surplus on December 31st, 1924, remained at the high figure of 7,932,738 dollars.

As regards the general business of the Patent Office, there were—

Applications for patents for inventions	76,855
Applications for designs	3,635
Applications for re-issues of patents	266
	80,756

The number of applications made under certain rules without fees amounted to 132.

As regards issues, there were—

Patents issued, excluding designs	42,594
Design patents issued	2,671
Patents re-issued	235
	45,500

The following table is of interest as indicating the number of patents issued to citizens of the United States, with the ratio of population to each patent granted:—

State.	Patents and designs issued.	Population corresponding to one issue.
Alabama	172	13,573
California	2,630	1,302
Connecticut	1,276	1,082
Iowa	656	3,664
Mississippi	92	19,463
New York	6,907	1,503
Pennsylvania	3,439	2,536
Washington	572	2,372

As regards patents granted to residents of foreign countries, the following figures are given:—

Australia	5
Austria	55
British India	4
Canada	736
Czecho-Slovakia	48
England	1253
France	440
Germany	993
Ireland	21
Isle of Man	2
Isle of Wight	3
Italy	84
Japan	45
New South Wales	56
Scotland	76
Sweden	146
Switzerland	199
Wales	14

The total number of patents granted to residents of foreign countries in 1924 was 4723.

HOT-WATER SUPPLIES FOR HOSPITALS.

AT the annual summer meeting of the Institution of Heating and Ventilating Engineers, held in Birmingham on Tuesday, June 23rd, Mr. Herbert G. Cathcart read a paper on "Hot Water Supply Installations for Large Infectious Diseases and Mental Hospitals," in the course of which he gave some interesting figures. Speaking of the extent of some of these hospitals, he stated that 2800 to 3000 tons of coal per annum were consumed in many of them for steam-raising alone, besides 500 to 850 tons for other purposes. Hence the necessity for careful consideration in designing plants for such a purpose as that referred to in the title of the paper. He then went on to speak of the importance of the centralisation of plant, the necessity for water softening in districts like London, the desirability of ample capacity in the storage of hot water, and the importance of providing spare or standby plant where a breakdown would cause the stoppage of a large part of the essential services. He emphasised the great value of suitable recording apparatus, distance registration pressure and temperature instruments, to furnish a record of the fluctuations in temperature throughout the day or week, and a reliable meter to register the total consumption of hot water, so as to obtain complete evidence of the running of the plant, the shortcomings of the staff, &c., and data of the plant's performance at all times.

Mr. Cathcart then exhibited a number of graphs, taken from installations of the Metropolitan Asylums Board, showing the hourly consumption of hot water over the twenty-four hours of the day, both Sundays and weekdays, which afforded interesting information as to where the hot water was used, the times and quantities of draw-offs, &c. Finally he warned his hearers of the vital importance of using none but the best non-conducting covering composition for covering the pipe lines, &c. He stated that the Board now used only pure magnesia and plastic asbestos, and required 85 per cent. efficiency, otherwise the material was rejected.

CANADIAN WATER POWER AND RECLAMATION SERVICE.

THE Dominion Water Power and Reclamation Service of the Department of the Interior of Canada has recently issued the annual review of its activities for the fiscal year ending March 31st, 1924. During the period covered by it the Dominion Water Power Branch and the Reclamation Service were amalgamated, and the annual reports formerly issued by each organisation are now combined in one report, which describes the various administrative responsibilities of the combined services under three main divisions of activity, namely, water power, irrigation, and drainage.

The report just published describes under the section on water power the administrative and investigatory responsibilities involved; the method of co-operation with the provincial authorities in the conduct of the Dominion Hydrometric Survey, and the scope of this work during the period under review; the available and developed water power in Canada as at February 1st, 1924; the use of water power in the mining, pulp and paper and central electric station industries in Canada; and the utilisation of water power in Canada in relation to coal production, importation, and consumption.

The reclamation section of the report describes the surveys and inspections made for irrigation, domestic water supply, and drainage purposes during the year under review; the irrigation undertakings in operation, under construction or projected which are under the supervision of the Department; the drainage schemes constructed or investigated by the Dominion; and research work in connection with the duty of water for irrigation, alkaline and other soils, rotation of crops and climatology.

Copies of the report will be supplied free of charge on application to the High Commissioner for Canada, Kinnaird House, Pall Mall East, London, or to the Director of Water Power and Reclamation, Ottawa, Canada.

Literature.

SHORT NOTICES.

French-English and English-French Dictionary of Technical Terms and Phrases used in Civil, Mechanical, Electrical and Mining Engineering and Allied Sciences and Industries, including Geology, Physical Geography, Petrology, Mineralogy, Crystallography, Metallurgy, Chemistry, Physics, Geometry, Abbreviations and Symbols, Weights and Measures, Compound Conversion Factors, &c., and a Method of Telegraphic Coding, by which any Entry in the Dictionary can be Expressed by a Ten-letter Cipher Word with Indicator and Check. By J. O. Kettridge, F.S.A.A., A.C.I.S., author of French-English and English-French Dictionary of Financial and Business Terms, Phrases and Practice. The civil engineering terms comprise those used in the surveying and construction of railways, waterways, roads, bridges, &c. The mining terms comprise those used in getting metals, coal, oil and other minerals, and quarrying, exploration, surveying, boring, excavation, sinking, drilling, ventilation, lighting, haulage, hoisting, assaying, ore-dressing, management, &c. The mechanical terms comprise those used in mechanical science, mechanisms, specifications of machinery, plant and tools, strength of materials, smelting, refining, founding and working of metals, building, carpentry and joinery, lighting and heating, steam, hydraulic, oil and gas engineering, rail locomotion, machine tool work, scientific research, &c. London: George Routledge and Sons, Ltd. 1925. Complete in one volume. 50s. net.—We have reproduced the greater part of the title page of this volume, because a description of a dictionary conveys nearly all that can be said about it until it has been in actual use for many months. The feature of the present example that strikes us principally is the excellence of the type faces employed. The words are given in a black-faced character and the translation in an ordinary lower-case character similar to that used for this notice. The translation, moreover, is indented. This arrangement makes reference easy, and the types are so clear that no trouble is experienced in reading. It is rarely that a dictionary which contains the "translation of one hundred thousand words, terms and phrases" is so clearly printed. It may help purchasers if we remark that from such inspection of the volume as we have been able to make, we gather that more attention has been given to mining and geological terms than to those of general engineering. That is not by any means to be regretted. Altogether, it is a volume on which both the author and the publishers are to be congratulated.

BOOKS RECEIVED.

Architectural Practice and Procedure. By Hamilton H. Turner. London: B. T. Batsford, Ltd., 94, High Holborn. Price 15s. net.

Power Station Operation. Vol. I. London: The *Electrical Times*, Ltd., Sardinia House, Kingsway, W.C. 2. Price 3s. 6d. net.

A Course of Metallurgy for Engineers. By F. C. Thompson. London: H. F. and G. Witherby, 326, High Holborn, W.C. 1. Price 25s. net.

Health and Environment. By L. Hill and A. Campbell. London: Edward Arnold and Co., 41 and 43, Maddox-street, W. 1. Price 12s. 6d. net.

Steam Power Plant Engineering. Sixth edition. By G. F. Gebhardt. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 30s. net.

Aerial Surveying by Rapid Methods. By B. M. Jones and Major J. C. Griffiths. London: The Cambridge University Press, Fetter-lane, E.C. 4. Price 16s. net.

Base Exchange in Soils. A general discussion held by the Faraday Society. London: The Faraday Society, 90, Great Russell-street, W.C. 1. Price 5s. net.

Marine Engineering Repairs. By Engineer Captain F. J. Drover, R.N. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 9s. 6d. net.

Das Torkrelverfahren und seine technischen Probleme. By Dr. Ing. Adalbert Szilard. Berlin: Julius Springer, Linkstrasse, 23–24, W. 9. Price 3 Gold Marks.

The Internal Combustion Locomotive. By J. W. Hobson, Newcastle-upon-Tyne: The North-East Coast Institution of Engineers and Shipbuilders, Bolbec Hall. Price 5s. net.

The Use of Copper and Brass for Domestic Water Services. Second edition. Birmingham: The Copper and Brass Extended Uses Council, Kings-court, Colmore-row. Price 2s. 6d. net.

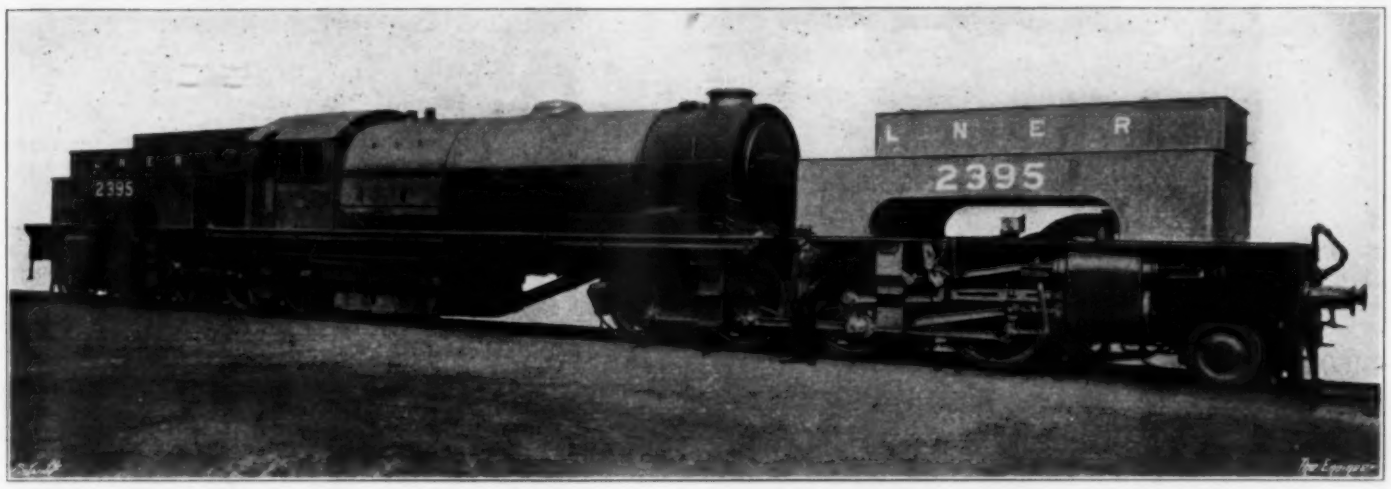
Steam Boilers: Their Defects, Management and Construction. Sixth edition. By R. D. Munro and G. Ness. London: Charles Griffin and Co., Ltd., Exeter-street, W.C. 2. Price 10s. 6d. net.

A Catalogue of British Scientific and Technical Books. New edition. Compiled by the British Science Guild. London: A. and F. Denny, Ltd., 163A, Strand, W.C. 2. Price 12s. 6d. net.

The Physical Chemistry of Igneous Rock Formation. A general discussion held by the Faraday Society, the Geological Society, and the Mineralogical Society. London: The Faraday Society, 90, Great Russell-street, W.C. 1. Price 6s. 6d. net.

LONDON & NORTH-EASTERN RAILWAY—GARRATT LOCOMOTIVE

CONSTRUCTED BY BEYER, PEACOCK AND CO., LTD., MANCHESTER

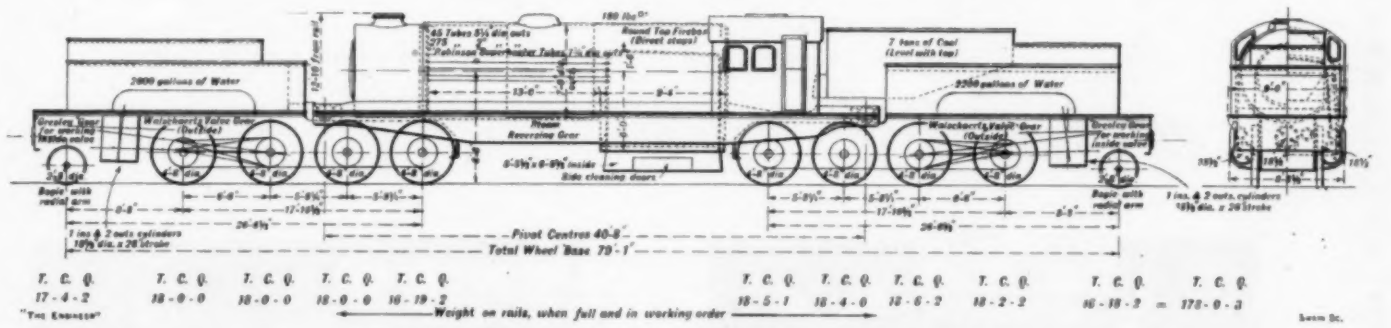


New Locomotives for the L. & N.E.R.

AMONGST the new engines that will take part in the wonderful procession of fifty-four locomotives and trains which will file past their Royal Highnesses the Duke and Duchess of York on the Stockton and Darlington Railway next Thursday, two engines of the London and North-Eastern Railway will attract especial attention as they represent types which are new to this country. We are able through the courtesy of Mr. Gresley to give a few particulars and illustrations of these noteworthy engines to-day.

The first of these two engines to pass the Royal box will be the 2-8-2, or Mikado, of which we reproduce a photograph on page 717, with a weight diagram and table of dimensions. This engine, which weighs 100 tons without its tender, has been designed by Mr. H. N. Gresley for working heavy and fast mineral trains between Peterborough and London. It will draw one hundred loaded wagons, weighing approximately about 1600 tons. The driving wheels are 5ft. 2in. in diameter. It has three cylinders, with Gresley valve gear and a "booster" modified to Mr. Gresley's designs. Its starting tractive effort with the booster in action is 47,000 lb., or practically 21 tons. It has only just been completed at Doncaster.

The second engine is a "Garratt," which is not only the first engine of the type for a British railway, but the heaviest yet built by Beyer, Peacock and Co., Ltd., and the first to have two three-cylinder engines. Each unit consists of a 2-8-0 engine, of which the cylinders, valve motion, &c., are interchangeable with those of the London and North-Eastern Railway 2-8-0 three-cylinder coal engines. It is to be used as a banking engine on the Worsboro' Branch, between Wath and Peniston, which is 7 miles long, all on a rising gradient, with 2 miles at 1 in 40 up. The trains weigh about 1000 tons, and are worked at present with two train engines in front and two or three banking engines behind. The "Garratt" will replace the banking engines. The boiler for this huge machine is 7ft. in diameter, and the tractive effort is equal to that of two of the London and North-Eastern Railway 2-8-0 coal engines, one of which will also take part in the procession at Darlington.



GARRATT LOCOMOTIVE FOR THE LONDON AND NORTH-EASTERN RAILWAY

Increasing Production.

(By a Contributor.)

IF we say that the law of gravity is obvious, and consider that thousands of years elapsed before Newton stumbled upon the fact, it may emphasise the lack of genius and ability to see the obvious in other directions; and, to some extent, may account for our characteristic fashion of "muddling through." The problems of industrial progress, so far as they relate to methods of labour efficiency and remuneration—Sir Frederick Mills, President of the Iron and Steel Institute, has said that a ton of steel consists of 90 to 95 per cent. labour—are nearly as old as the law of gravity, but judging from modern history, in place of recognising the seeds of genius developing according as their citizens succeed or fail that States rise to greatness or decay."

Sir Alan Smith, President of the Engineering Employers' Federation, says: "Increase the working hours in the engineering trade from forty-seven to fifty and make further labour concessions."

Now, let us look at contrasts like the following:—

A.

From a report of a paper read before a meeting of the Institution of Engineers and Shipbuilders in Scotland on "Premium-bonus Systems."

"In conclusion," the writer said, "he suggested to the would-be inventor of a new system, that he should sketch in what he considered to be the desirable premium (or rate) curve, which may not have a change of curvature, and which may not have only three points in a straight line. Then tabulate four values of premium (or rate) and time taken; and turn to the general second degree equation, and solve for the four coefficients. No doubt unwieldy equations will generally result, but oft-times approximations and simplifications will suggest themselves, which may make the equation suitable for practical application."

B.

From "Payment by Results," by Priestman Brothers, Ltd., Hull.

"If a given number of men in a given time are capable of producing on the ordinary method of day-rate working a certain quantity and type of finished machinery (called the Standard Output), then if, by greater collective individual effort—that is, without increasing the number of men or working any longer hours per man—they can increase the output of such machinery, it is possible to advance their total day rate wages by a percentage equivalent to that by which the standard output has been increased."

The author of instance A was reported to have made his suggestion after having been instructed to investigate the matter—"'Premium-bonus System of Payment': What is a 'Premium-bonus'?"—and it was stated in the report that the outstanding features of his paper is that it is an independent inquiry into a subject which has been prominently before the engineering industry for a few years past. The paper mentioned, particularly interested the members of the Institution of Engineers and Shipbuilders in Scotland; copies were eagerly read by members of kindred institutions, and, in numerous cases, the relative curves and equations were made the subject of the most minute examination by the technical staffs of important engineering concerns.

Messrs. Priestman apparently tackled the question of increased output at reduced cost without the aid of curves and equations. In fact, they introduced into their scheme a very elementary encouragement feature, which, had the scheme shown no results, must have proved very costly. The encouragement consisted of a promise to pay an increase of 10 per cent. whether the fixed average output was exceeded or not. Result of the scheme: Within a few months production increased to the extent of between 40 and 50 per cent., and wages earned were actually paid by results.

It does not require mathematical qualifications to estimate the economic value of a system based on principles of this kind. But it is very obvious that the Priestman system does not appeal to many captains of industry, and especially to those in engineering and similar trades, despite the fact it has received the unqualified approval of every trade union, whereas so-called premium-bonus systems only very grudgingly have been allowed to operate.

Another striking instance of increased production which should be broadcast and dinned into those "who cannot see the wood for the trees," is quoted from an article in THE ENGINEER, by Mr. F. J. Sharr:—"The experiment was started in a manufacturing machine shop, divided into ten departments and employing 750 men working under a premium-bonus system. The men are strong trade unionists, and, owing to cliques and their retention of membership in trade unions, the loyalty of the foremen was suspect. The aim of the experiment was the promotion of goodwill in the men; the basis of the method, the exhibition of goodwill by the management.

"Three examples will perhaps serve to indicate broadly the nature of the 'conditions' offered:—

"(1) In order that each man shall be placed in a position to determine for himself 'How do I stand?' a standard of performance was established, which the management agreed to accept as satisfactory.

"(2) The value of superior work is recognised, and is rewarded by giving to each man control over the security of his own employment.

"(3) Fairness of trial, in cases of discipline, is ensured by defined procedure, and is exercised as a right, not as a favour.

"Under this new incentive men are no longer content to lie down under preventable inefficiency. A new and keen interest in the promotion of efficiency all round has, in fact, been created in the men, exerting a subtle but powerful influence right outside the shops in which the system is nominally operating. The outcome of this, in conjunction with the will to work also created, has been the attainment of the following results. In considering them, the strongly marked trade union character of the shops, already mentioned, should not be overlooked. When it is taken into account, the significance is considerably enhanced.

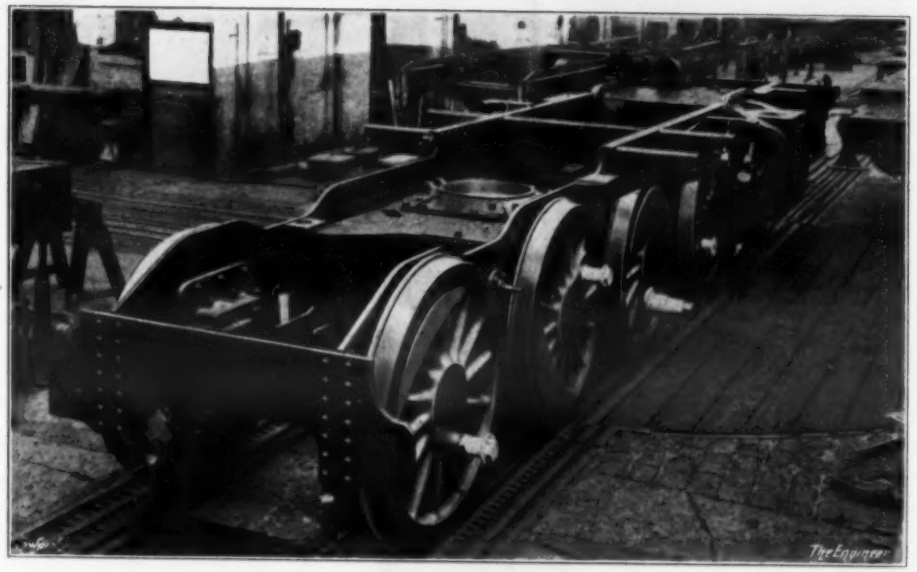
Average Figures for a Period of One Month.

	At start of experiment.	Two years later.	
Wages per week ..	£3433 9s. 8d.	£1561 7s.	.. Red. 54½%
Output, finished parts per week	43,750	57,570	.. Inc. 31½%
Output per man per week	69.7	106.5	.. Inc. 53%
Scrap, total value per week	£194	£73	.. Red. 62½%

The examples given of Messrs. Priestman's and Mr. Sharr's schemes might be extended, as they do not cover

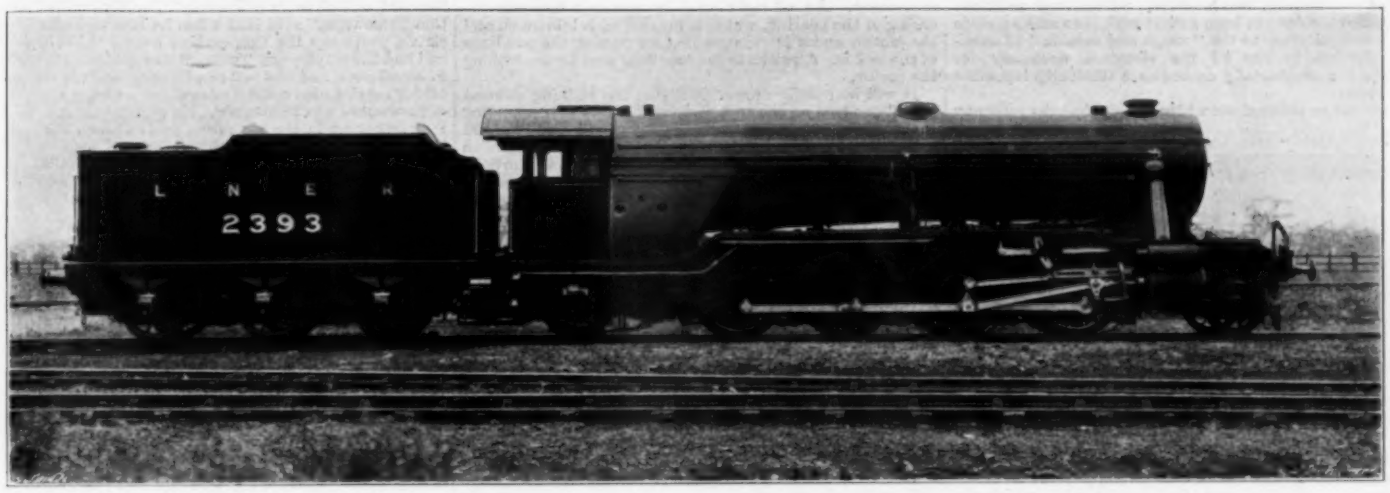
GARRATT LOCOMOTIVE FOR THE LONDON & NORTH-EASTERN RAILWAY

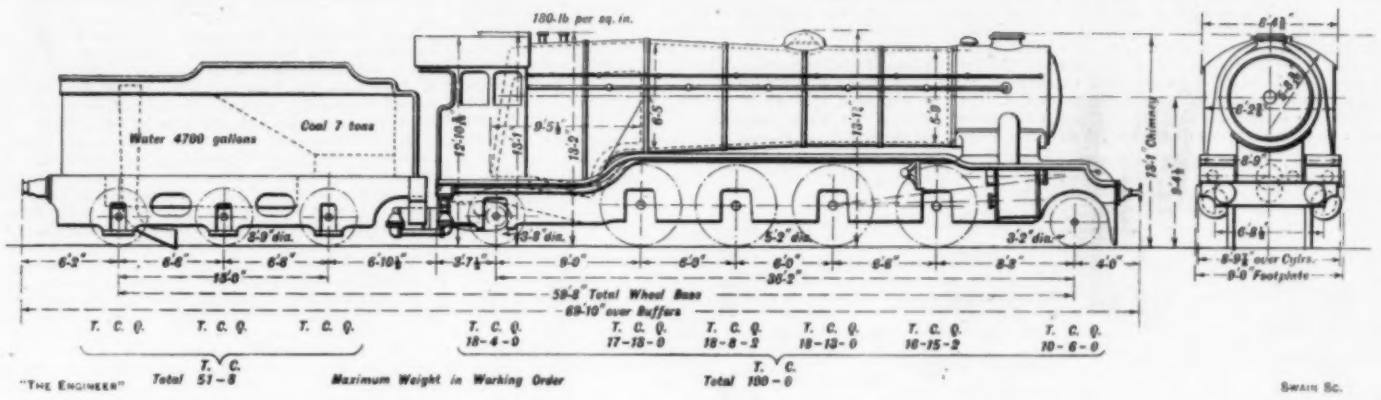
(*For description see page* 715)



LONDON & NORTH-EASTERN RAILWAY—MIKADO LOCOMOTIVE

CONSTRUCTED AT DONCASTER TO THE DESIGN OF MR. H. N. GRESLEY





Leading Dimensions and Ratios.

Grate—	
Length on slope	5ft. $10^{25}/_{32}$in.
Width	6ft. 11½in.
Grate area	41.25 square
Fire-box—	
Height of crown above foundation ring:	
Front	6ft. $8^{13}/_{16}$in.
Back	6ft. $0^{9}/_{16}$in.
Interior length at top	7ft. 11½in.
Interior width at boiler centre	5ft. 4½in.
Thickness of copper plates:	
Sides and back	$^{9}/_{16}$in.
Tube plate	$^{9}/_{16}$in. & 1⅛in.
Boiler—	
Outside length fire-box overall	9ft. 5½in.
Outside length fire-box at bottom	6ft. 8in.
Outside width fire-box at bottom	7ft. 9in.
Diameter of barrel, maximum	6ft. 5in.
Length of barrel	19ft.
Thickness of barrel plates	⅞in. & $^{11}/_{16}$in.
Thickness of wrapper plates	$^{9}/_{16}$in.
Outside diameter of smoke-box	6ft.
Outside length of smoke-box	5ft. 11in.
Type of superheater	Robinson
Tubes, small—	
Material	Steel
Number	168
Diameter outside	2¼in.
Thickness	10 I.W.G.
Tubes, superheater flue—	
Number	32
Diameter outside	5¼in.
Thickness	$^{5}/_{32}$in.
Length between tube plates	19ft.
Heating surface—	
Fire-box	215 square feet
Tubes, small	1880 square feet
Flues	835 square feet
Total evaporative heating surface	2930 square feet
Superheater—	
Number of elements	32
Diameter inside	1¼in.
Heating surface	525 square feet
Total heating surface	3455 square feet
Two Ross pop safety valves	4in. diameter
Working pressure	180 lb. per square inch
Boiler horse-power	1815

Axles—	Dia.	Length.
Journals, pony truck	6¼in.	9in.
Coupled wheels	8½in.	9in.
Trailing wheels	6in.	11in.
Crank pins, outside	5½in.	6in.
Crank pins, inside	8½in.	6in.
Coupling pins—		
Leading	4½in.	3½in.
Driving	6½in.	4½in.
Intermediate	4in.	5in.
Trailing	4in.	5in.

Springs—
Pony truck: Helical, 10½in long, free, $5^{1}/_{16}$in. outside diameter, Timmis section.
Coupled wheels: Laminated, 3ft. 6in. centres, 9 plates, 5in. wide by ⅝in. thick.
Trailing: Laminated, 4ft. 6in. centres, 14 plates, 5in. wide by ⅝in. thick.

Cylinders—	Engine.	Booster.
Number	3	2
Diameter and stroke	20in. × 26in.	10in. × 12in.
Cylinder horse-power	1946	—
Motion—		
Type outside	Walschaerts	Direct
Type inside	Gresley	—
Type of valve	Piston	Piston
Diameter of valve	8in.	—
Maximum travel of valves	5½in.	—
Steam lap	1¼in.	—
Exhaust lap	−⅛in.	—
Cut-off in full gear	75 per cent.	—
Tractive effort at 85 per cent. boiler pressure	38,500	—
Tractive effort of booster	—	8,500
Total adhesive weight	160,160	40,768
Adhesive weight ÷ tractive effort	4.16	4.79
Brake, steam and vacuum	Ejector	—

the whole aspect of output increase and cost reduction, although both go a long way towards recognition of "the obvious." Meanwhile, the engineering and allied trades are endeavouring to find a solution of present difficulties by asking for increased working hours, &c. It would be a waste of time to quote recent utterances by people who, unfortunately, talk without understanding, and keep on reiterating hackneyed platitudes about labour costs.

The foregoing is not a plea in the interest of labour. Trade unionists frequently indulge in adding their quota of verbiage to that of the other side. That the interests of Capital and Labour are synonymous should be obvious.

It is pathetic to find people in this country making statements like that contained in the answer to an election time query by a prominent industrial magnate:—Q.: Do you agree that American motor manufacturers, such as Henry Ford, who pay their workers higher wages than similar workers are paid in England, can successfully compete with British motor manufacturers? If so, is it your opinion that these British motor manufacturers are incompetent and that incompetence of this description should be protected? A.: Ford's competition is difficult to meet owing to mass production and the consequent low cost. Give the British manufacturer the protection he needs, and his massed production, I think, will defy competition.

And, apparently, very little is being done with respect to the recommendations contained in the report of the Committee on Commercial Efficiency, which has been inquiring into our trade methods and prospects for the British Industries Federation, namely:—More co-operative action between manufacturers; adoption of a standardised basis of costing; interchange of costings, to secure a common policy; educational committees to be set up in each industry; standardisation of plant and production; collective advertising; all catalogues for foreign markets to be in the language and have the weights and measures and prices set out in the standards used in the country approached; firms should combine and maintain jointly travellers and selling agents. Possibly this report has been accorded similar treatment to that usually given to the reports of Royal Commissions.

The subjects of oncost and standard costing, which are of vast importance, and which are very imperfectly comprehended, also suggest directions in which the obvious may be discovered.

The evidence (frequently unpalatable) of those who, like Messrs. Priestman and Mr. Sharr respectively show 40 to 50 per cent. increased output, and 31½ per cent. increased output, by different methods, are entitled to greater respect and emulation than the puny—and doubtful—results of increased working hours.

Sir Alfred Mond recently expressed himself very forcibly regarding "capital without energy." He pointed out several instances of German methods which we would do well to copy. Think of it! It is necessary for British industry to be dependent upon the stimulus of the competitive methods of other countries—apart from labour conditions—to make headway! In this connection, there is a long list of developments which had their origin in America—high-speed tool steel and consequent machine tool construction, mass production, fatigue study, &c., and even our pet systems of what are erroneously termed premium-bonus plans.

Books of Reference.

The Railway Year-book, 1925. London: The Railway Publishing Company, Ltd., 33, Tothill-street, Westminster, S.W. 1. Price 5s. net.—In the volume just received the main feature is the re-arrangement which has been found necessary under the grouping system. Many changes appear in the Irish section, including two new maps, one of the Great Southern Railway system and the other the Northern Counties Section (Northern Ireland lines) of the London, Midland and Scottish Railway. The British section has been thoroughly revised, and new maps have been prepared for the sections dealing with the Southern, Somerset and Dorset Jt., Metropolitan and "Underground" systems. A new feature of this book is a comprehensive index in addition to the classified contents. Foreign railways and those in our Colonies and Protectorates have now been placed in sub-classes according to their geographical location. The Who's Who section has been thoroughly revised and brought up to date.

The Universal Directory of Railway Officials, 1925. London: The Directory Publishing Company, Ltd., 33, Tothill-street, Westminster, S.W. 1. Price 20s. net.—This directory is compiled from official sources, under the direction of the Editor of the *Railway Gazette*. A complete list of all the chief railway officials all over the world is given. The volume is divided into eleven sections, and contains a personal index of railway officials, and an alphabetical index to names of railways. The whole volume has been revised and brought up to the beginning of May, 1925.

A New Form of Electric Hammer.

LAST week we witnessed a demonstration of the capabilities of a new type of electrically-operated hammer, which is being introduced by the Kango Company, Ltd., of 78, Petty France, Westminster, and although sufficient experience has not yet been gained with it to make certain how it will stand up to the "rough and tumble" of workshop service, it has all the elements necessary for success, and incidentally embodies a distinctly ingenious mechanism.

It should be pointed out at the outset that the company

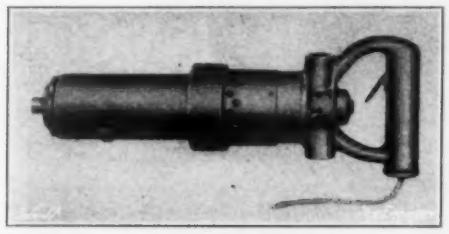


FIG. 1—THE KANGO ELECTRIC HAMMER

has, so far, concentrated on the manufacture of a hammer for comparatively light work, such as chipping, stone dressing and wall drilling, and the hammer with which the demonstrations were made was essentially of that type; but its principle is adaptable to heavier work, as is explained later, and it is hoped to develop the tool for riveting and other more arduous services. The broad principle of the hammer is the invention of Professor Goldschmidt, but the Kango tool is being manufactured entirely in this country and differs in detail from the original model.

On reference to the drawing Fig. 2, it will be observed that the tool comprises two distinct sections arranged in a

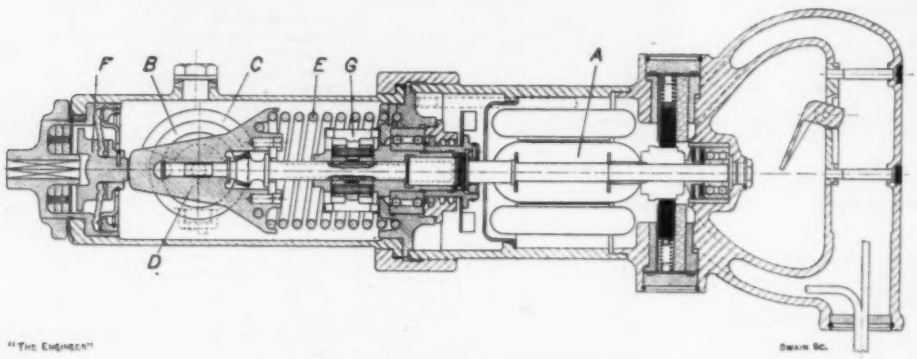


FIG. 2—SECTION THROUGH THE KANGO HAMMER

casing, which measures roughly 17½in. by 4½in. in diameter. The driving power is supplied by a motor A, which runs at about 10,000 revolutions per minute, and will work on either alternating or direct-current. The consumption is about 1.4 ampères at 220 volts. This motor drives a pair of bevel wheels, one of which is shown at B, with a gear ratio of about 3 to 1. The two bevel wheels mesh with one pinion on the extension of the motor spindle, so that they revolve in opposite directions. Each bevel wheel is provided with a heavy weight C on one side, so that they are out of balance, and the various parts are so assembled that, in the position shown in the illustration, the two weights are diametrically opposed. In these circumstances it will

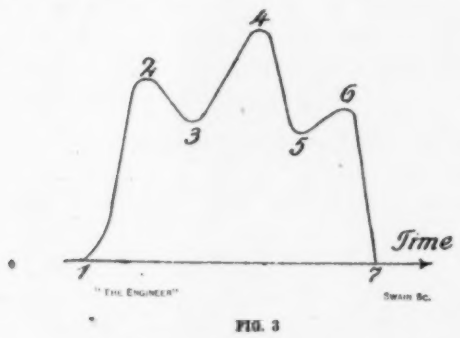


FIG. 3

be seen that as the weights rotate they will act in unison longitudinally to the general axis of the tool, but will more or less balance one another transversely. The result is that a violent longitudinal vibration is transmitted to the axes of the bevel wheels B.

The bevel wheels are mounted in a floating frame D, which is free to move longitudinally, and is controlled by a spring E. The result is that the floating frame is given a reciprocating motion, and it provides a "striking element" which, in conjunction with the "transmitter" F can be used to strike blows on any tool slipped into the socket beyond the transmitter. It will be noticed that the transmitter is held in place in the casing by means of a leather diaphragm, which makes a flexible oil-tight joint.

It is obvious, in these circumstances, that the bevel pinion and its shaft must be free to slide longitudinally with respect to the motor spindle, and for this reason the two shafts are coupled together by a peculiar little flexible coupling G.

This coupling takes the form of an internally castellated sleeve sliding on the splined shaft of the bevel pinion. On either side of the sleeve there is pivoted a loose T-shaped arm which engages with a slotted cage connected with the motor spindle. The arrangement is such that the T arms provide a positive rotary drive to the castellated sleeve, and consequently to the pinion shaft, but allow free longitudinal movement. An oil-tight joint is arranged between the casing of the gearing, which is flooded with lubricant, and the motor, and a fan is provided for cooling the windings of the motor. A switch in the handle is used for controlling the motor.

It will be readily appreciated that the striking element D will produce on the tool a series of blows corresponding to its rate of revolution, the intensity of which will depend upon the weight of the various parts; but the mechanism has further possibilities, as suggested earlier in this article. By speeding up the rotation of the fly-weights it is possible so to time the impulses, as regards the movements of the striking element, that there is an accumulative effect, as indicated in Fig. 3, which is reproduced from the patent specification of the inventor. This graph represents the condition of affairs when the striking element, or tup, makes a blow only once in every three revolutions of the fly-weights. From 1 to 2 there is a normal stroke of the tup, but on the return stroke the point 3 is arrived at when the fly-weights have passed the dead centre, so the tup is carried further forward to 4. At this point the accumulative effect starts in the opposite direction, and the blow is finally produced, at 7, with the energy represented by the abrupt fall from 6 to 7. It is on these lines, we understand, that the heavier tools, already referred to, are to be developed. It is, however, essential for these purposes that the speed of the motor should be constant within fairly close limits, as the critical speed within which the accumulative effect is produced is confined within comparatively narrow limits.

During the demonstration, to which we have already referred, the tools were handled by an expert, and were used for a variety of purposes, such as chipping mild steel plate, dressing marble slabs, and punching holes through brick walls, and we noted that the time taken to produce a ½in. hole 4½in. deep in hard red brick was 34 seconds. There was no opportunity to determine the amount of electricity consumed, and although the actual consumption of such a tool is of minor importance, provided it "does its job," it was obvious that the current used could not have been very great, as the lead was plugged into an ordinary lamp socket on a circuit with normal fuses. Our own experience, on handling the hammer, was that with one or two minutes' experience it could be controlled quite comfortably.

BRITISH WATERWORKS ASSOCIATION.

THE fourteenth annual general meeting of the British Waterworks Association will be held in the Council Chamber of the Guildhall, London, on Wednesday afternoon, July 1st next. The British Waterworks Association and the Institution of Water Engineers are holding their summer meetings this year in the same week. On Thursday, the 2nd prox., the members of both bodies will visit works of the Metropolitan Water Board, including the Staines Reservoirs, the new Littleton Reservoir and works, and the Walton works. On the Friday visits will be paid to the West Wickham pumping station of the Metropolitan Water Board and to the works of the East Surrey Water Company at Purley and Reigate. Saturday will also be available for visits to other works of the Metropolitan Water Board. The president-elect is Mr. Alderman C. G. Musgrave, Chairman of the Metropolitan Water Board and Vice-Chairman of the Essex County Council. It is hoped that the Minister of Health will be present at the annual dinner on the evening of July 1st, when representatives from America and the Colonies as well as from the majority of water undertakings in the kingdom will be gathered together.

THE VITALITY OF TRAMWAY TRANSPORT.

"FAR from tramways being a back number, I am of the opinion that there is no form of transport which can compete with the tramcar of the present day," said Mr. P. Priestly, manager of the Liverpool tramway undertaking, in speaking at a dinner held in connection with the annual meeting of the managers' section of the Municipal Tramways Association, which took place last week at Plymouth. "It is a significant fact," he continued, "that during the course of a year the whole population of Great Britain is carried on the tramcars several hundred times, and I wonder if the man in the street who reads articles about scrapping the tramways realises what it would mean if the trams of the United Kingdom were done away with." These remarks were made in replying to the toast of "The Municipal Tramways Association," proposed by the Mayor, who remarked that the Association represented a capital expenditure of £71,000,000 and commanded an income of £26,000,000, mostly in coppers. Mr. John Barnard, of Bolton, in proposing "The Plymouth Corporation Tramways," said that when he last visited the town eleven years ago the Corporation owned thirty-four cars and had 230 employees. To-day it was running 140 cars and 27 omnibuses, and had 900 employees. In 1914 the undertaking carried nine million passengers; to-day the number of passengers was 38,000,000. He firmly believed, he said, that transport in the big towns was as much the duty of the municipalities as gas, electricity and water supplies, and all they asked from the Government was that they should be put on an equal footing with private individuals. Alderman W. H. Welsford, replying on behalf of the Tramways Committee, said that he remembered the first tramlines being laid in the streets of Plymouth fifty-three years ago. The cars were then driven by docile horses at an ambling trot. There was, he added, no fear for the future of the Plymouth tramway system. Mr. H. P. Stokes, the Tramways Engineer, who also responded, mentioned that Plymouth was the first town in the country to introduce street transport by steam, although that method was not long continued.

The conference, which met for the first time in the West of England, was attended by the managers of eighty tramway undertakings in the large towns of Great Britain and Ireland.

MACHINERY TRADE IN GERMANY.

THE Commercial Secretary at Cologne—Mr. C. J. Kavanagh—has informed the Department of Overseas Trade that, according to the *Deutsche Bergwerks Zeitung*, of June 12th, the Association of German Machine Works reports that inquiries and orders have decreased during the past few weeks, and that employment during May—with a few exceptions—was more unfavourable than in the preceding months. The number of works which were well or sufficiently employed has decreased by 10 per cent., whereas the number of those complaining of bad business has increased by 50 per cent. Mr. Kavanagh explains that, in estimating the employment of works, it should be taken into consideration that most of the works are not employed to their full capacity, the number of workers having been decreased by an average of 30 per cent.

Export business during the past few months has, Mr. Kavanagh adds, been at a very low level, and in May the position became still worse. Of the total orders received by the German machine industry during recent months, not more than 20 per cent. fell to exports, whereas in the preceding years export orders amounted to some 25–30 per cent. The machine building industry has therefore recently become more and more dependent upon the home market, and the adverse effect of the decline in home orders is correspondingly greater. Amongst those suffering from the aloofness of the large works are particularly those firms which manufacture power engines, plant for the mining industry, for smelting, steel and rolling mills, machine tools, &c.

STANDARD MOTOR CAR PARTS.

THREE new standards for automobile parts have just been published by the British Engineering Standards Association.

One is a revised edition of the specification for wide type concentric piston rings. The revision consists of a slight reduction in the width of the gap when the ring is placed in a gauge of nominal cylinder diameter. It is intended that the gaps shall be hand-fitted, as necessary, to give the gap required in the cylinder. No alterations have been made to the diameters, widths or thickness of the rings.

Another deals with the dimensions for carburetter flanges (two-bolt type). These dimensions were originally prepared by the Society of Motor Manufacturers and Traders, and are practically identical with those of the S.M.M. and T. provisional standard No. 11, originally issued by the Institution of Automobile Engineers as I.A.E. Data Sheet No. 109. They were submitted to the British Engineering Standards Association for consideration and approval, and have now been issued as a British standard. When it is realised that the carburetter is one of the components which is so often changed on a car or lorry when attempting to improve the running or the consumption of fuel of a vehicle, it is satisfactory to know that, when this standard is widely adopted, it will be possible to fit any of the makers' productions without costly alterations to the inlet pipe or manifold. Such interchangeability will benefit the users as well as the makers, and the new B.E.S.A. report should be well received for that reason.

The third publication defines the British standard method for the calibration of carburetter jets for aircraft and automobile engines. The calibration and marking of carburetter jets have in the past been standardised by various makers on different lines, so that there has been no common standard of reference. Furthermore, it was found that jets of the same make, size and diameter did not necessarily pass the same amount of fuel under similar conditions. Hence, various users as well as manufacturers adopted a flow basis of calibration in place of dimensional calibration. The present specification includes the recommendations of the British Engineering Standards Association on the standard method of calibration and marking of carburetter jets on the flow basis. A master jet-calibrating machine and a set of accurately constructed master jets have been deposited with the National Physical Laboratory as a standard of reference for jet sizes. Copies of these three new issues are obtainable from the B.E.S.A. publications department, 28, Victoria-street, Westminster, S.W. 1, price 1s. 2d. each post free.

THE INSTITUTION OF WATER ENGINEERS.

THE thirtieth summer general meeting of the Institution of Water Engineers will be held in London on Tuesday, June 30th, and on Thursday, Friday, and Saturday, July 2nd, 3rd, and 4th, 1925. The following programme has been arranged:—By permission of the President and Council of the Geological Society, the meetings will be held at Burlington House, Piccadilly. On Tuesday, June 30th, the chair will be taken at 10.30 a.m. by the retiring president, Mr. John Chisholm, M. Inst. C.E., and the business will include the presentation of premiums awarded by the Council for papers read during the past year; the installation of the president-elect, Mr. A. E. Cornewall-Walker, M. Inst. C.E., engineer to the East Surrey Water Company, and the reading of his presidential address; also the reading and discussion of papers. In the evening the thirtieth annual dinner of the Institution will be held at the Hotel Russell, Russell-square, at 7.15 for 7.30.

On Thursday, July 2nd, at 10 a.m., a visit will be paid to the Staines Reservoirs, the Littleton Reservoir, intake and works, and the Hampton works of the Metropolitan Water Board. Motor coaches will leave the Metropolitan Water Board head offices, Rosebery-avenue. Luncheon will be taken at Bridge House Hotel, Staines, and tea at the Hampton works. The return to London will be made by motor coaches.

On the Friday, at 10 a.m., motor coaches will leave the Metropolitan Water Board head offices, Rosebery-avenue, for the West Wickham pumping station, which will then be inspected, after which the party will be conveyed to Purley, where luncheon will be taken at the invitation of the chairman and directors of the East Surrey Water Company. After luncheon the Purley works of the East Surrey Water Company will be inspected. The party will then be driven to the water tower at Margery, Reigate Hill, where tea will be served by invitation of Mrs. Cornewall-Walker. On returning to London the members will inspect the London County Hall.

On the Saturday visits will be paid, according to the desires of members, to other works of the Metropolitan Water Board, viz.:—(*a*) The Walton pumping station, Surrey; (*b*) King George Reservoir at Chingford; (*c*) high-pressure filter at Barnes; or (*d*) Sunbury chlorinating plant. The following papers and communications will be presented at the meeting:—"Scottish Rainfall," by Mr. W. M. McClean, A.M. Inst. C.E.; "The Effect of Contractions in Open Channels and the Measurement of Discharge in Open Channels by a Venturi Flume," by Professor A. H. Jameson, M. Inst. C.E.; "Recent Studies relating to the Purification of Water and the Action of Various Waters on Lead and Copper Pipes," by Dr. John C. Thresh and Mr. John F. Beale; "Chesterfield New Waterworks," by Mr. Charles Boldry; and "The Afforestation of Catchment Areas," by Colonel J. R. Davidson, M. Inst. C.E.

LAUNCHES AND TRIAL TRIPS.

MOBILOIL, oil tank steamer; built by the Greenock Dockyard Company, of Greenock, to the order of the Vacuum Oil Company, Ltd.; dimensions, length between perpendiculars, 394ft.; breadth, 53ft.; depth moulded, 28ft. 9in.; total deadweight 7250 tons on a mean draught at sea not exceeding 23ft. Engines, triple-expansion, 27in., 44in. and 73in. by 48in. stroke, pressure 180 lb.; boilers fitted for burning liquid fuel on the Todd system, combined with Howden's forced draught; launch, June 8th.

CARIBOU, passenger steamship; built by the New Waterway Shipbuilding Company, of Schiedam, to the order of the Newfoundland Government; dimensions, 267ft. between perpendiculars, breadth moulded 41ft., and depth moulded to upper deck 25ft. 6in.; to carry 250 first and second-class passengers in addition to 1300 tons deadweight on a mean service draught of 17ft. 6in. Engines, one set of inverted triple-expansion, 23½in., 40in., and two 46in. diameter by 42in. stroke, pressure 200 lb.; the vessel was designed and is being built under the superintendence of A. Goodwin-Hamilton and Adamson, Ltd., of Liverpool, and is of specially strong construction in view of her having frequently to encounter ice; launch, June 9th.

INVERCAIRO, shallow-draught twin-screw oil vessel; built by Harland and Wolff, Ltd., Belfast, to the order of Andrew Weir and Co. for the Lago Shipping Company, Ltd.; dimensions, 315ft. long by 50ft. broad; 2360 gross tons. Engines, triple-expansion, pressure 180 lb.; constructed by the builders; delivered to owners after satisfactory trials in Belfast Lough, June 9th.

SUN XII., screw tug; built by Earle's Shipbuilding and Engineering Company, Ltd., of Hull, to the order of Mr. W. H. J. Alexander, of London; dimensions, 100ft. by 25ft. 6in. by 12ft. 8in. moulded. Engines, triple-expansion, 15½in., 24in. and 40in. by 27in. stroke, pressure 180 lb.; constructed by the builders; the vessel is fitted with salvage pumps and fire extinguishing arrangement by Merryweather, of London; launch, June 9th.

LURGURENA, vehicular ferry steamer; built by J. Chrichton and Co., Ltd., at Saltney, to the order of the Tasmanian Government for service at Hobart; dimensions, 199ft. by 35ft. 6in. by 14ft.; 248 tons net. Engines, triple-expansion, 1100 indicated horse-power; constructed by Plenty and Son, Ltd., of Newbury; the vessel has now begun the voyage to Tasmania under her own steam; trial trip, recently.

GLENLEDI, steamer for service on the Canadian Lakes; built by Swan, Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne, to the order of Mr. James Playfair (Great Lakes Transportation Company, Ltd.); length, eventually to be 379ft.; to carry about 4825 tons on 18ft. draught in fresh water. Engines, triple-expansion; constructed by the North-Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne. In order that the vessel might pass through the locks of the Welland Canal, Ontario, 144ft. of the midship body has been omitted; that portion will be fabricated at the builders' yard and taken out to the Great Lakes in the vessel herself, which, after passing through the canal, will be docked, cut in two, and the fabricated portion built in place by the owners, thus completing her full dimensions of 379ft. long; launch, June 10th.

FORRESDANK, twin-screw motor cargo vessel; built by Harland and Wolff, Ltd., at Govan, to the order of Andrew Weir and Co. (Bank Line, Ltd.); 5200 gross tons. Engines, two sets of six-cylinder Harland-B. and W. motors; delivered to owners after running satisfactory trials on the Clyde, June 11th.

BELVOIR, single-screw steamship; built by Swan, Hunter and Wigham Richardson, Ltd., at Wallsend, to the order of the International Waterways Navigation Company, Limited, of Montreal; dimensions, 248ft. between perpendiculars, 46ft. 3in. moulded width, and 25ft. moulded depth. Engines constructed by MacColl and Pollock, of Sunderland; trial trip, June 12th.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(*From our own Correspondent.*)

Situation Unchanged.

THERE is but little movement to report in the iron and steel industry in the Midlands and Staffordshire. To-day's market in Birmingham showed little sign of life, though the attendance was moderately good. Buyers were in an insignificant minority, and the few orders given out were of small dimensions. Consumers are buying just as much as will enable them to fulfil engagements, and no more. The uneasy poise of prices effectually checks any desire to speculate. There is a tendency for prices to drop still lower, as the result of continental imports. Staffordshire mills re-rolling steel are in a comparatively good position, but here also there is a considerable proportion of plant idle.

Manufactured Iron.

The recent reductions in Staffordshire iron prices have brought no perceptible increase of new business, the wide disparity between iron and steel prices leading to the preference for the cheaper material, except where the peculiar merits of Staffordshire iron are a condition in the constructional contract. The incoming orders for finished iron are small. Firms which specialise in high-grade material are not so badly hit as those that depend more particularly on standard lines. Business is spasmodic however, and production is carried on under very disadvantageous conditions. One or two Staffordshire ironworks report slightly better business, but activity is almost entirely restricted to the rolling of steel. There is no material alteration in prices. Marked iron commands £14 10s., Crown qualities £12 7s. 6d., and nut and bolt and fencing iron £11 7s. 6d. per ton. Continental competition is extremely keen, and Belgian quotations this week were lower than ever. Against them Staffordshire firms have no chance of competing, and a very large percentage of the common bars being used are of foreign origin. Wrought iron gas tube strip prices continue easy at £12 15s. upwards, but steel strip at £8 15s. commands the greater sale, users being indisposed to employ the higher-priced material.

Pig Iron.

The pig iron market remains very weak. The forges are doing next to nothing, and the heavy engineering foundries give no sign of improvement. Not for a very long time has the pig iron department been so unsettled. The policy of consumers generally is to buy only for immediate requirements, as delivery can be obtained promptly. Leading merchants state that orders frequently range from 15 to 20-ton lots, whereas formerly the bookings seldom went below 50 tons. There has been no formal revision of quotations, but values are anything but strong. The output is considerably in excess of current consumption. Users are carrying only the minimum stocks, so that uncommitted surpluses in the hands of furnacemen are growing. A small quantity of Belgian pig iron has been sent into this district; but the railway transport for the most part makes buying from abroad unprofitable. Northampton foundry iron continues at £3 7s. 6d., and Derbyshire £3 12s. 6d. These prices could be shaded for an attractive contract, but with furnace coke steadily weakening, consumers rely on still lower prices in the future. Some very cheap lots of coke have lately been offered.

Steel.

Local steel works are somewhat busier, and in one or two cases are making full time. Generally, however, the operations do not absorb more than 50 per cent. of the capacity. Several steel works in the Midlands will benefit from the further orders for steel given out by the London, Midland and Scottish Railway. This steel has to be delivered in rather small instalments, but it will be useful to supplement the orders for constructional steel which are received with fair regularity, but much heavier tonnages are wanted to give regular employment. The demand for structural steel is possibly a trifle better, but quotations are being finely cut by the home makers. From abroad competition continues severe. One hears of price shading when there is any prospect of good orders being placed. Prices have to be cut to the bone in order to secure employment for plant and *personnel*. The fight between Wales and the North-East Coast for the structural plate trade in the Midlands has gone in favour of the Northerners, who are ready to deliver at £9. They would go lower, so it is said, rather than be beaten. It is a significant illustration of the severity of present conditions, for the orders in question are inconsiderable. The foreigners are competing keenly for finished products. Steel bars are offered at £5 12s. 6d. f.o.b., ship plates at £7, and joists at £5 17s., and there is some reason to conclude that a large amount of the foreign business which normally would come to this country is being taken by Belgium. Some of these orders are dealt with through Birmingham merchants. The English price for bars and sections is £8 7s. 6d. The few works lately asking higher figures have now receded to the general level. Welsh mild steel billets are still being offered at £6 15s., and there are repeated reports of their being sold at £6 10s. Most of the makers want more than that, however. Belgian billets are half-a-crown cheaper at £6, having eased along with other continental material with the deterioration of the franc exchange. As the margin between native and foreign billets is narrower than usual, British steel is increasingly preferred, especially as a good deal of the Belgian material received lately has been reported to be unsatisfactory. With prices receding, there is practically no forward buying, all the material called for going into immediate consumption. Germany is not sending much into this country, but has sold some wire rods much below English prices. Consumers regard German steel as, on the whole, of better quality than Belgian. Builders are taking advantage of foreign joists, of which about 7000 tons were imported last month. The imports for the five months show substantial increases on those of a year ago, mainly on account of the rate of exchange.

Galvanised Sheets.

Makers of galvanised sheets who have orders on hand which will keep them employed for a few weeks to come still quote £16 10s. for 24 gauge. Buying has fallen off, however, and the price position is not what it was. The galvanised sheet department headed the list in the total of its exports for May, although the tonnage was hardly equal to that of a year ago. For the five months the increase is substantial.

Steel Scrap.

Steel scrap sells slowly, with considerable suspension of delivery. This material is not being pressed on the market so keenly as it was, holders of stocks preferring to wait for better prices.

Iron and Steel and Protection.

Considerable apprehension has been excited in Midland iron and steel and engineering circles concerning the application of the iron and steel trades for protection under the Safeguarding of Industries scheme. Even the iron and steel trades themselves are not united as to the advisability of the safeguarding of the industry, and there is a large volume of opinion which frankly holds that safeguarding would lead to disaster. The subject is a very debatable one, and on 'Change in Birmingham to-day—Thursday—it formed the topic of many conversations.

Coventry Engineering.

There is a slight slackening down here and there, indicating the advance of the season, in the Coventry motor engineering factories, but for the most part the works continue as active as ever. The season has been an encouraging one up to the present, and granted a continuance of industrial peace, the city's chief industry will retain a healthy tone for some time to come. The recovery of the export trade is necessarily gradual, but it is being maintained, and in certain instances a very fair amount of business is now being done.

Derbyshire Miners on Notice.

Miners working at the Swanwick collieries, Alfreton, Derbyshire, were recently asked to agree to a reduction in wages price lists to enable work to proceed during the present trade depression. The men declined, and now the owner has given notice to the men employed at the old pit to terminate their engagements. Already large numbers of miners in the district are receiving unemployment pay, and the ranks will be swelled by the closing of this pit.

Workless.

The unemployment barometer in the Midlands continues to ascend, the total having increased by a further 2574, being 171,017, as against 168,443 on the last weekly return. This, following upon the increases of the two previous weeks, makes the addition to the ranks of the workless in three weeks of no less than 13,526. The position is very serious in some districts, and additional stations have had to be opened by the Ministry of Labour to cope with the rush to sign the unemployment register. The Birmingham area shows a decrease of roughly 400 on the week, while in Coventry also the numbers have declined slightly. At Bilston, Cradley Heath, Dudley, Oldbury, Smethwick, Tipton, Wednesbury, West Bromwich, Wolverhampton, and other Black Country areas the figures are lower, so that the heavy engineering and iron and steel producing neighbourhoods appear to be faring better than such places as Leicester, Nottingham, Redditch and Stoke-on-Trent, where the figures are mounting.

LANCASHIRE.

(*From our own Correspondents.*)

MANCHESTER.

General Outlook.

THERE is very great depression in the iron and steel markets here this week, although it is not so obvious in the non-ferrous markets. The position in iron and steel seems to go from bad to worse and the amount of business being done in this district is dwindling. To show how far this dwindling has gone it is only necessary to note the reception of orders for steel doors which was reported from the Manchester Canal Company. About as much fuss was made about it as if it had been a much more important bit of business, whereas it does not involve more than about 500 tons of plates, which could be made and delivered by one of the North-Eastern steel makers in a couple of days, or three at the outside. When such comparative trifles are hailed with satisfaction it is clear that the condition of the trade must be in a bad way. It is now generally realised that for the next two months very little new business will materialise, and the most that can be done will be to keep the prices from sagging any more before the autumn trade—if there is to be any—sets in.

Metals.

The market for the non-ferrous metals here has been fairly steady and people engaged in it are not nearly so doleful as those dealing in iron and steel. It is true that many engineers are short of work and the actual buying of metals here is not very great, but there seems to be a little more confidence as to the prices. This is perhaps engendered by the persistent reports as to the lessening of copper production in North America. If this continues and the consumption of copper be maintained, there is no doubt that the statistical position of the metal will soon be much better. Some doubt, however, has been thrown on the point as to whether all the recent sales of

copper, especially to Europe, were genuine sales, and it has been suggested that part of this business may be simply a transfer of stock. There may, of course, be some truth in this suggestion, but nevertheless there has been a great diminution of American copper stock during the last five years. There seems to be a belief that this process of reduction is still going on, and that in the course of the next month or so American stocks will be reduced to a fairly moderate figure—some say to under 100,000 tons of refined metal. The better feeling in copper and the slight rise in standard have induced makers of sheets to put their official price—for the home trade—back to £90 per ton. The upward turn does not altogether justify this at the moment, but may do so later on; that is to say, so far as the price of sheets at home can be justified when so much less is being taken for export. Tin has been a fairly steady market for some time and the general position does not show much difference. There has been as yet no very serious increase in the production of tin, and if the demand keeps at or near the present rate one cannot see that prices are in much danger. So long as the fluctuations are kept within about £5 per ton either way the market may be called quite equable. There has been some indication that American consumers were beginning to take more interest in the metal, but large American buying has not yet set in. Lead is not considered a very strong market at present prices, but there is no immediate indication that a slump is near at hand. There have been large arrivals, but consumption is such that the market seems able to absorb them. At any rate, lead is not being pressed for sale at the moment.

Pig Iron.

The markets here for all kinds of pig iron are very dull and quiet, and it is clear that to keep the prices from further sagging is a difficult task. Makers, of course, have the cost of production as a support to the market, and they make the most of it; but it is very difficult to keep up prices on cost alone. In the blast-furnace industry the question in times of depression is always how much it is worth while to lose rather than to blow out a furnace. Recently the failure of the demand for steel-making pig iron has led to some increase in the supply of foundry quality in this district, and is tending to weaken the market again. Derbyshire No. 3 iron has been heard of at less than 80s. in Manchester, and consumers here are inclined to believe that the price will fall to 77s. 6d., or, in other words, to the even figure of 70s. at the furnaces. Northamptonshire iron seems weak again and the prices taken for Lincolnshire are rather uncertain. Cleveland, of course, is still out of the question, but that market is also weak and it is doubtful whether present prices can be maintained. Hematite and Scotch iron remain easier, but the latter is not now of very much interest to Lancashire. There is no indication that any revival in the demand for new textile machinery is near at hand, although, of course, it is well known that such machinery is needed in Lancashire.

Finished Material.

The demand here for manufactured iron and steel is no better, and some people admit that it seems still to be dwindling. Buyers ought to be satisfied about the prices for steel, although they are no doubt justified in objecting to the Lancashire iron prices; but the fact is that foreign material is easier again, mainly on the low value of the franc, and while this is so buyers feel that British material may still come down. The nominal prices here are much as they were, but competition for any orders that come into the market is keener than ever, and in such circumstances it is obvious that concessions in prices will be made. For a long time foreign iron has been enormously cheaper than British iron, and the tendency now is to widen the gap between foreign and British steel.

Scrap.

Dealers here in old iron and steel are doubtful as to the future, and seem to fear that a further reduction in the selling prices may yet take place. There seems to be no demand whatever now for Lancashire steel scrap, either from Sheffield or from South Wales, and one is quite unable to say what prices will be offered when buying recommences. Dealers here are offering 50s. per ton, but they are not anxious to buy at that figure. For heavy wrought scrap the ironworks in Lancashire are still paying 75s. per ton, but they do not want much and are rather particular as to the quality. For foundry scrap there is only a very moderate demand and the prices for common qualities are weaker. Fairly good broken machinery metal is usually quoted at 75s. to 77s. 6d. per ton delivered, but there is a scarcity of really first-class "textile" or loom cast scrap, and for this as much as 82s. 6d. per ton has to be paid. Founders grumble at having to pay more for this scrap than for No. 3 pig iron, but they forget that formerly such scrap brought nearly the price of Scotch pig, and for this they would have to pay at least 99s. per ton here.

The Ronald Lindsay Johnson Playing Fields.

On Saturday last what are known as the "Ronald Lindsay Johnson Playing Fields" were formally declared open by Mrs. W. H. Johnson. These fields owe their inception to the late Captain Ronald Lindsay Johnson, youngest son of the late Mr. William Henry Johnson—one of the partners of the firm of Rd. Johnson, Clapham and Morris, Ltd., before it was converted into a limited company—who was killed in France, May 29th, 1917. Captain Johnson, by his will, directed his executors to use certain funds for the benefit of the employees of Rd. Johnson, Clapham and Morris, Ltd., of which firm he was chairman of directors at the time of his death. The executors, after a considerable amount of investigation, eventually obtained an order of the Lancashire Chancery Court which enabled them to purchase 8 acres of land close to the Moston Works of the company, where the majority of the employees work. This land is situated practically in the highest part of Manchester, and is closely surrounded by other Corporation playing grounds. The board of directors of the company joined themselves with the trustees, who are appointed by the Court, in making a donation to the funds of the trustees which would equal all the rates and taxes on the land, together with a surplus towards maintenance and upkeep. This assistance has enabled the trustees to lay out the field in a most advantageous manner. Considerable work has been done in levelling the ground and a thorough system of drainage has been installed, so that it is hoped, no matter how damp the season, play will be continuous throughout the year.

BARROW-IN-FURNESS.

Hematite.

There is no improvement in the hematite pig iron trade, and as further evidence of the slump in trade the North Lonsdale Iron Company at Ulverston has damped down a furnace. The stocks which remain in makers' hands are still considerable and the rate of clearance is slow. This fact accounts for the further reduction in output. At Carnforth the furnace is working from day to day and may stop at any time. In Cumberland the position is not so bad, for the steel works are taking a fair quantity of the iron produced at present. Since the beginning of the recent falling off in trade there has been no stoppage of any furnace in the Cumberland district. There is a certain amount of iron going out of the district, the Midlands taking a fair proportion; but the orders are small and there is not the slightest inclination to order more than is barely necessary. The fall in the franc is certainly responsible to a very great extent for the present poor trade. There is practically no business with the Continent, and, on the other hand, the Continent is a competitor. Even in the scrap market the Continent has the pull. There is more iron on order for America, but the clearances of late have not been heavy.

Iron Ore.

The position in the iron ore trade is worse in view of the further damping down of furnaces, and the Furness district is doing very little. Most of the activity is in Cumberland, but even there there is much restriction and some of the mines are producing very little. Foreign ore is coming in, but in reduced amounts, in view of the poor outlook.

Steel.

There is nothing fresh to report as regards the steel trade. The Barrow rail mills are still idle. The Workington rail mills have the L.M.S. order to deal with, but fresh orders are necessary to keep them going for any length of time. The hoop and small section mills at Barrow are better situated for orders and are working regularly.

Shipbuilding and Engineering.

The Barrow-built Warren liner Newfoundland, which had successful trials a week or two ago, met with a mishap when out off Ireland with her first load of passengers and mails for Newfoundland. A fault developed in one of her pistons and she came back to Belfast, where she received attention. This steamer did a knot and a-half above her contract speed of 14 knots.

SHEFFIELD.

(From our own Correspondent.)

No Improvement in Crude Steel.

THE condition of things in the raw material and semi-manufactured departments of the steel trade shows no change for the better. If anything, matters are still worse, and the outlook is correspondingly less cheerful. The Far Eastern troubles, the depressed state of the coal trade, and the great increase of unemployment in the country, are all factors which tend to produce pessimism. There are many authorities who maintain with confidence that things will still right themselves, but the desired improvement does not yet appear to be on the horizon. The falling off in the demand for coal has resulted in cheaper fuel being available for manufacturers, and this in turn has been followed by reductions in the price of crude steel. Only a few weeks ago basic billets went down by 10s. per ton, and now there has been a similar drop in Siemens acid billets, the minimum quotation for which is £11. These concessions, however, have not stimulated buying, consumers no doubt preferring to withhold all but urgent orders in the hope of further reductions. That there is ground for such hope is shown by the fact that huge stocks of coal and coke exist, which are unsaleable except at heavily cut prices. The railway branch is still one of the best employed in the heavy steel trade, but it is not nearly in full work. Although the home railway companies are not sending any of their orders abroad, this is not the case with overseas companies, which are placing with this country much less work than could be desired.

The Manufactured Side.

Those steel firms which make a speciality of colliery requisites are feeling the effects of the coal slump severely, as the colliery companies are buying little or nothing in the way of stores and equipment. Manufactured steel products of the lighter varieties are faring much better than the heavy side of the trade. The recovery of the file trade is well maintained, and the volume of products now turned out is in excess of the pre-war figure. There is much activity in various tool branches, particularly spades and shovels, farm tools, knives, and steel parts for agricultural implements. A great deal of the export ground lost by these trades during the war has now been regained. The home trade in farm and garden tools has enjoyed a good season, garden tools particularly having been in such demand that the productive capacity has been employed to its utmost. A considerable demand for tool steel, and tools made therefrom, is maintained by the motor and electrical industries. The hack saw makers are well employed.

Cutlery and Plate.

Depression continues to be the ruling feature in the cutlery and plate trades. A few firms are busy on large contracts for railway and ship supplies of goods of the highest class, but these bright patches only accentuate the darkness of the state of general trade. Exports of cutlery in May showed a falling off as compared with April, the values being respectively £46,579 and £50,484. Included in the exports were 72,983 dozens of knives and blades, 3239 dozens of scissors and shears, 13,261 dozens of safety razors and blades, and 3075 dozens of ordinary razors. The decline was chiefly in safety razors and blades. It is believed that the returns for June will show a further decline. Sales of spoons and forks, and electro-plate, also show a drooping tendency, and a very unsatisfactory feature is the reduction in buying by Australia, New Zealand, and Canada. There is still a good sale for cheap spoons and forks, as well as cutlery, but the volume is not as large as formerly. Increasing competition in hollow-ware is reported from Birmingham, where, for a number of articles prices on the pre-war level, or even below it, are being quoted.

Government Contracts.

A number of contracts for various supplies have recently been given out by the Admiralty and War Office. The Admiralty placed orders as follow:—Britannia metal goods, Cooper Brothers and Sons, Walker and Hall, James Dixon and Sons (Sheffield), T. Wilkinson and Sons (Birmingham); gun-metal cocks and fittings, W. N. Baines and Co. (Rotherham); medical glass ware, Beatson Clark and Co. (Rotherham); hydroplanes, Vickers Ltd. (Barrow). The War Office contract for files and rasps was obtained by Thos. Firth and Sons, and those for tool steel by A. Balfour and Co. and William Turner and Son.

A New Colliery Sinking.

The tale of colliery developments in the West Riding of Yorkshire is continually lengthening, and the latest news is of an important enterprise at Houghton Main, near Barnsley. Advances have been begun which, to quote a statement by Brigadier-General Sir J. F. Laycock, D.S.O. (chairman of the directors), should be "the means of providing successful employment for many hundreds of men for many years to come." The enterprise consists in the working of the Parkgate seam. The existence of the coal, at a depth of 780 yards, has been proved, and sinking operations are now in progress, which are expected to last about two years. They are being carried out by Messrs. Blandford and Gee, of Doncaster. It is anticipated that a considerable depth of water-bearing strata will have to be gone through, and in order to overcome this difficulty the cementation process will be employed. There are some interesting features in connection with the surface equipment. The engine-house and headgear are of ferro-concrete. Messrs. Markham and Co., of Chesterfield, are building the engines, which will be capable of performing one wind per minute. Steam will be generated by water-tube boilers, using pulverised fuel. For the removal of refuse from the pits, an aerial ropeway capable of transporting 50 tons per hour is being erected. A coal-washing plant is also to be installed, with a spiral separator which mechanically removes the dirt from the coal in a spiral shoot.

More Coal Items.

The Dinnington Main Coal Company reports that the erection of its new coal washery has proceeded satisfactorily during the past year, and that the linking up of the Dinnington, Maltby, and Rossington Collieries with the Yorkshire Electric Power Company's system has been completed. The sinking of a new pit at Upton, near Pontefract, is causing rapid expansion of the villages of Upton and North Elmsall, and new works of sewerage and sewage disposal are becoming necessary. A Ministry of Health inquiry was held last week into an application of the Hemsworth Rural Council for sanction to borrow £17,500 for these purposes. It was stated that already 79 houses had been erected at Upton for the colliery company, and that it was proposed to erect over 500 more in the two villages. The colliery company has undertaken to provide some of the money required for the sewerage work free of interest until the rateable value of the place increases.

An Order for Steamers.

It is announced that Cammell, Laird and Co., Ltd., of Sheffield and Birkenhead, have booked an order from Elders and Fyffes for two steamers for the passenger and fruit trade between the West Indies, Central America, and Europe. This order increases to nine the number of vessels which Elders and Fyffes have ordered from Messrs. Cammell since the war. The order will be beneficial to the heavy steel trade of Sheffield.

Cast Iron Houses.

I hear that Newton, Chambers and Co., Ltd., of the Thorncliffe Ironworks, near Sheffield, to whose demonstration pair of cast iron houses I referred last week, have received an order from the Wortley Rural District Council for the building of six of these houses at Mortomley.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

THOUGH prices in the Cleveland pig iron trade are a trifle easier as compared with a week ago, the industrial position does not show any further deterioration; on the contrary, there has been a slight improvement. The month's shipments will be swollen by some substantial parcels of iron despatched to Denmark this week under old contracts, the fulfilment of which has been held up by the strike in that country. Moreover, a few export orders have been placed for shipment to Baltic ports, where delivery is only possible in summer months. At home the demand is still very quiet, but the fact that a few foundries have been buying iron confirms the view that many of them are absolutely bare of stocks, and cannot afford to

Supplement to The Engineer, June 26, 1925

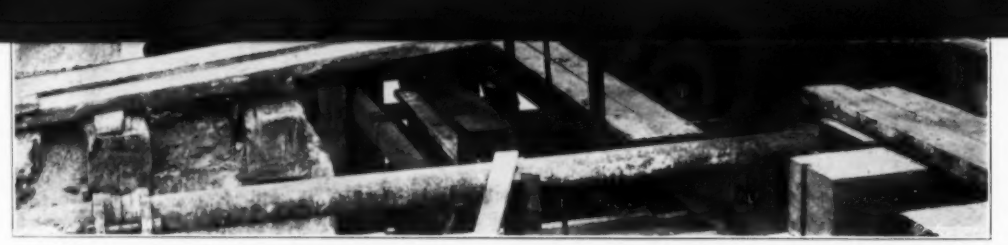
WATERLOO TEMPORARY BRIDGE—NAVIGATION SPAN

SIR WILLIAM ARROL AND CO., LIMITED, GLASGOW, ENGINEERS

SPAN ERECTED ON OLD BRIDGE

RUNWAY FOR TROLLEYS AT NORTH END OF SPAN

SPAN ERECTED ON OLD BRIDGE



RUNWAY FOR TROLLEYS AT NORTH END OF SPAN

STAGING AND RUNWAY GIRDERS

TRAVERSING TACKLE ON RUNWAY

SPAN LOWERED ABOUT FIVE FEET

ONE OF THE NORTH END BEARINGS

wait any longer. Possibly the view is also taken that prices cannot fall any further. There are growing fears of trouble in the coalfield, and, of course, if there should even be a hint of a stoppage, fuel and pig iron prices would go bounding up. Thus it seems not to be the time to expect further cuts in prices, and Cleveland makers are adhering fairly steadily to 73s. per ton as the price of No. 3 G.M.B. to home consumers. As much as 74s. is quoted, and has, in fact, been paid for export, notwithstanding the lower figures quoted for continental iron. No. 1 foundry iron stands at about 77s. per ton, No. 4 foundry at 72s., and No. 4 forge at 71s. 6d.

Hematite Pig Iron.

There is little change of moment in the East Coast hematite pig iron trade. The supply, limited though it is, remains fully adequate for the needs of the trade, and, indeed, there are ample stocks to dispose of. However, makers are not inclined to cut prices any further, and although it is not a minimum 78s. 6d. per ton is an average market rate for mixed numbers with 79s. per ton for No. 1 quality.

Ironmaking Materials.

The foreign ore trade is as quiet as ever, and 21s. 6d. per ton is merely a nominal c.i.f. price for best Rubio ore. Good furnace coke is still quoted at 21s. per ton delivered at the furnaces, but the market favours buyers and discounts are possible.

Manufactured Iron and Steel.

Some improvement is to be noted in the manufactured iron and steel trade. By taking very low prices steel makers are keeping most of the mills fairly well employed. Further substantial orders have been placed in this district for heavy steel rails for overseas shipment, and there is also a fair number of specifications for constructional material On the other hand, it is difficult to find employment for the plate mills, and this is the slackest section of the trade. There is no material change in prices.

The Coal Trade.

The position of the Northern coal trade continues to go from bad to worse. The market this week has presented a listless tone in consequence of the annual holidays in the Northumberland coalfield, and a lean time is anticipated until July comes, though even for that month operators do not expect any pronounced revival of demand. At the week-end, four more pits belonging to the Pelaw Main group closed down after notices had been tendered to the men, some 2000 of whom were affected. Other pits in different parts of Northumberland and Durham, which seemed to be nearing the point of closing down, have entered into local negotiations with a view to keeping the workers employed. In the Durham area alone there are now over fifty collieries idle, but this has had no beneficial effect on the balance of output, and even now collieries have great difficulty in working five days a week. Exporters are experiencing a very difficult time. The demand from European countries has fallen to very small proportions, and this is reflected in the shipments of coal and coke from the Tyne last week when they showed a decrease of 149,379 tons, as compared with the corresponding period of a year ago, the respective totals being 394,968 tons and 245,589 tons. For a week or two the majority of producers are only moderately booked, despite the limited output, and buyers can readily secure additional quantities at easy prices. Best steams continue to hold for 16s. 9d. per ton, but there is no pressure. In the Durham gas coal trade, all grades are subject to bargaining, though some producers still hold out for 18s. per ton for best qualities. There is no demand for coke, and the position remains very easy for gas production, but patent coke output is limited to requirements, and quotations are steady.

SCOTLAND.

(From our own Correspondent.)

General Inactivity.

THE passing of time has wrought no change in the industrial situation generally, and the position in the steel, iron and coal trades in particular is most unsatisfactory and discouraging. There is little interest in the markets, owing to the difficulties in the way of doing a meagre turnover, even when the prices quoted are unremunerative. The slackness in the shipbuilding yards on the Clyde has a large influence on business in this area, and many steel and ironworks are on the verge of closing down until busier times. Balance sheets of public companies here and there amply testify to the state of trade during the past months, two well-known concerns showing a loss of approximately £500,000 and £160,000 respectively, while the opinion is often expressed that many others have relatively been through just as trying a period.

Dull Outlook.

The outlook in the West of Scotland is far from bright, and the possibility of industrial unrest is a further worry. The state of affairs in the coal trade causes great anxiety, and there are rumours of wages troubles in other sections of industry. Consequently, consumers are dubious about placing orders, while producers are equally cautious, though the inclination is to take anything offering while business is so slack. The annual holiday season is not due for about three weeks yet, but there is a strong probability that many concerns will close down earlier than usual, probably at the end of the present month.

Steel.

Apart from business in sheets, the steel market is more or less idle. Ordinary black sheets of the lighter descriptions have a fair turnover, but the demand for galvanised varieties is the bright spot at present. The former are named about £10 per ton, and the latter are firm at £17 10s. per ton for 24 b.g., f.o.b. Glasgow. Plates and sections are in little or no demand. Boiler plates are, of course, unchanged in price, but ship plates and sections can be done below the nominal prices of £8 12s. 6d. and £8 2s. 6d. per ton respectively. Scrap material is plentiful and cheaper.

Iron.

The bar iron works are just as they were. Difficulty is met with in securing sufficient orders to maintain a minimum degree of employment. Local demands are "off," and export is meagre. Re-rolled steel is almost as inactive, and prices have to be severely cut in order to obtain even small lots. Continental competition is severe, and is noticeable in pig iron also. Home-produced pig iron is plentiful and easier in price, but considerable quantities of foreign material are being consumed in this district, especially continental basic and foundry. The latest consignment of foundry amounted to 1500 tons, which arrived about a week ago. Scottish hematite and No. 1 foundry are named £4 7s. 6d., and No. 3 foundry £4 5s. per ton, but easier terms can be arranged. Bar iron is unchanged at £11 12s. 6d. per ton for Crown quality for home delivery and re-rolled steel bars can be done about £8 5s. per ton home or export.

Coal.

While there is a firmer tendency in certain qualities of fuel, the general position of the trade is unchanged. Export business, apart from some demand for Lanarkshire splints and Fifeshire steams, single nuts and pearls is dull in the extreme, and the home market is no better off. Owing to considerable reductions in output, the fuels mentioned above have stiffened somewhat in price, single nuts and pearls in particular being scarce at present. All other descriptions are stagnant, and prices can be easily arranged. Aggregate shipments amounted to 250,732 tons, against 203,295 tons in the preceding week, and 249,334 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THE position in the steam coal trade has undergone no improvement during the past week, and the conditions are as quiet and dull as ever. At the end of last week there were between twenty and thirty idle loading appliances at the various docks, and fresh arrivals of tonnage have not put a very much better complexion on affairs, as at the beginning of this week there were 16 berths idle. The demand for tonnage continues to be very moderate and, taken on the whole, the position of the collieries is far from a comfortable one, except in isolated instances. The fact that the future is so unpromising from the labour point of view has not so far induced much if any fresh buying of coals. The possibility of stoppage of work taking place at the end of July has not influenced foreign buyers to operate though, of course, the next week or so may bring in some new orders in anticipation of trouble being experienced in the coalfield. Most people in the coal trade find it rather difficult to be anything but pessimisitic regarding the future, though hoping for the best. There was a meeting of the coalowners of South Wales at Cardiff on Monday, the proceedings being, of course, private, but it is generally understood that the meeting was in favour of giving notice to terminate the present wages agreement, and it is fully believed that the Central Council of the Mining Association of Great Britain, following out the wishes of most of the district associations, will decide this week to adopt the course of serving the notices necessary to end the agreement on July 31st.

Coalfield Items.

The trouble in the coalfield mentioned last week affecting the miners employed at the Llanbradach pits did not last long, as the workmen decided to resume, in view of the decision of the management not to negotiate until they were back at work. It was feared at one time that a serious stoppage was imminent at the Tredegar collieries. About 2000 men employed at the Markham Colliery came out owing to a dispute which concerned very largely rival trade unions, but the stoppage only lasted 24 hours. About fifteen hundred miners are affected by notices which have been given to terminate their employment at five collieries of the United Anthracite Company, and which were due to expire the middle of this week. The dispute centres round a question of alleged victimisation. Turning to North Wales the co-operative experiment at the Vauxhall Collieries, Ruabon, has come to an end and work has been stopped. This took place on Wednesday of last week. It was officially announced that while output had increased under the scheme and working costs reduced it was impossible to continue the arrangement owing to the fall in the price of coal. The proprietors have offered to reopen the collieries if the men will accept the proposal that the slack price payable on 5 per cent. of each man's output shall be applicable to the whole of the slack raised without prejudicing each man's right to the minimum of 9s. 5d. per shift.

South Wales Miners' Federation Affairs.

The annual conference of the South Wales Miners' Federation is being held at Cardiff this week, and most of the resolutions which have been framed by the various lodges to come up for discussion are of the somewhat hardy annual type, such as "six-hour day to reduce unemployment," that the seven-hours day be strictly observed in order to prevent overtime, and that a five-day week be put into operation. Others press for nationalisation, and another advocates a levy of 1d. per ton on coal raised for the purpose of pooling it to assist non-paying collieries. The balance sheet of the Federation shows that last year the total receipts were £120,977, of which £112,827 represented members' contributions. The total expenditure came to £125,373, and the total worth of the funds on December 31st last stood at £97,922, as against £102,318 a year previous. The heaviest expenditure last year was in respect of relief for unemployed miners, the total amount distributed in grants and strike pay and lock-put pay being £69,460, compared with £32,592 in 1923. The membership on December 31st last was 148,469, as against 147,611 the previous year.

Tin-plate Troubles.

The tinmen in the South Wales tin-plate industry decided at an unofficial meeting at Swansea on Saturday to tender notices on July 6th next in furtherance of their wages demand. There were about 200 delegates present, representing about 55 per cent. of the workmen. Hopes are entertained that the trouble will be smoothed out. There was also a meeting of the workmen's side of the Joint Industrial Council of the tin-plate trade on Monday last, when matters affecting every department in tin-plate works were discussed with a view to their being presented for consideration by the joint standing committee of the Council.

Dock Dues.

Some months ago a valuable concession was granted by the Great Western Railway Company to owners of vessels using the docks at Cardiff, Penarth and Barry, by which vessels were enabled to move from one dock to another within the Customs port of Cardiff without incurring double dock dues, the only extra charge being a locking fee. This week an influential deputation has interviewed the chief docks manager of the company to advocate an extension of this concession to the other ports in South Wales, as this would give greater elasticity to the trade. The representatives of Newport urged that, in any event, if the arrangement could not be made to apply to all ports as a whole, Newport should be included in the arrangement.

Current Business.

Business on the steam coal market has been at a very low ebb during the past week, and the market displays easiness all round. The demand from abroad is meagre in the extreme, and is badly affected by the adverse conditions of the foreign exchanges. Prices in all grades are irregular, and the competition for orders is very keen. Anthracite coals are somewhat weaker. A feature of the market is the sharp advance in the price of pitwood. There is a scarcity of supplies, and it is understood that this is likely to continue for several weeks. A good deal of the pitwood labour employed in France is at the present time engaged temporarily in agriculture. Whereas a week ago the price was round about 26s., quotations are now approximately 30s.

Latest News from the Provinces.

WALES AND ADJOINING COUNTIES.

Agreement Notices.

THERE is to be a special meeting of the Conciliation Board for the South Wales coal trade on Monday. It has been called by the employers' side in order to enable the necessary steps to be taken to terminate the national wages agreement and the local agreements conforming with it. It is expected that the workmen's representatives will request the owners to state their proposals so that negotiations can be started, and it is likely they will ask for information as to whether any new arrangement is to be by way of national negotiations resulting in a national agreement or by district settlement. The miners are opposed to any sectional agreement.

Colliery Sale.

It is reported that Guest, Keen and Nettlefolds, Ltd., have sold their interest in the Cyfarthfa colliery at Merthyr. This colliery has been idle since September last. When working about 2000 men are employed.

CATALOGUES.

DELCO-REMY AND HYATT, Ltd., 111, Grosvenor-road, S.W. 1.—Leaflet giving details and prices of the Hyatt lineshaft bearings and fittings.

REAVELL AND CO., Ltd., Ranelagh Works, Ipswich.—Pamphlet No. 127, describing the firm's vertical, two-stage, double-acting air compressors.

THE "MONITOR" PATENT SAFETY DEVICES, Wallsend-on-Tyne.—Booklet entitled "Safe Working of Air Compressors," describing the "Monitor" safety device.

T. C. JONES AND CO., Ltd., Shepherd's Bush, W. 12.—Hand and machine tool catalogue G 12/25, illustrating and describing the tools kept in stock for the general engineer and the contractor.

THE DUBILIER CONDENSER COMPANY, Ltd., Victoria-road, W. 3.—List A 12, describing the Dublier mica condenser type 610; and List A 13, describing the Dublier "Vanicon" variable air condensers.

THE ENGLISH ELECTRIC COMPANY, Ltd., Queen's House, Kingsway, W.C. 2.—Publication No. 494 entitled "Electric Locomotive Equipments"; publication No. 471 on truck type switchboards; and publication No. 340 containing illustrations of electric winding plants.

SOCIETY OF MOTOR MANUFACTURERS AND TRADERS.—At a meeting of the Council of the Society of Motor Manufacturers and Traders, Ltd., held on June 18th, the following were elected as officers of the Society for the current year:—President, Sir William M. Letts, K.B.E.; vice-presidents, Mr. R. W. Maudslay and Mr. W. Peto; honorary treasurer, Mr. Leslie Walton. The following were elected members of the Finance Committee:—Mr. L. Walton (chairman), Mr. H. G. Burford, Colonel J. A. Cole, Colonel J. Sealy Clarke, Mr. H. M. Hobson, Sir W. M. Letts, K.B.E., Mr. H. Shankland, Mr. J. K. Starley, Mr. H. E. Timson, and Mr. G. M. Young.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	20/-
(1) Spanish	21/-
(1) N. African	21/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	21/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 6 0	—
No. 1 Foundry	4 6 0	—
No. 3 Foundry	4 4 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 18 0	3 18 0
No. 1	3 18 6	3 18 6
Cleveland—		
No. 1	3 17 0	3 17 0
Silicious Iron	3 17 0	3 17 0
No. 3 G.M.B.	3 13 0	3 13 0
No. 4 Foundry	3 12 0	3 12 0
No. 4 Forge	3 11 0	3 11 0
Mottled	—	—
White	—	—
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	10 10 0	—
North Staffs. Forge	3 17 6	—
,, ,, Foundry	4 7 6	—
(3) Northampton—		
Foundry No. 3	3 7 6	—
,, Forge	3 4 0	—
(3) Derbyshire—		
No. 3 Foundry	3 11 6 to 3 12 6	
Forge	3 8 0	—
(3) Lincolnshire—		
No. 3 Foundry	4 0 0	
No. 4 Forge	3 15 0	—
Basic	3 15 0	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 12 0 (a) / 4 14 6 (b) / 5 0 0 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	11 12 6	—
Best ,,	—	—
N.E. COAST—		
Common Bars	11 12 6	—
LANCS.—		
Crown Bars	12 0 0	—
Second Quality Bars	11 10 0	—
Hoops	15 0 0	14 15 0
S. YORKS.—		
Crown Bars	13 0 0	—
Best ,,	13 10 0	—
Hoops	14 10 0	—
MIDLANDS—		
Crown Bars	12 7 6	—
Marked Bars (Staffs.)	14 10 0	—
Nut and Bolt Bars	11 7 6	—
Gas Tube Strip	12 15 0 to 13 0 0	

STEEL.

	(6) Home. £ s. d	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	12 10 0	—
Ship Plates, ½in. and up	8 12 6	—
Sections	8 2 6	—
Steel Sheets, under 3/16in. to ½in.	10 0 0	—
Sheets (Gal. Cor. 24 B.G.)	—	17 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 10 0	—
Angles	8 5 0	—
Boiler Plates	12 10 0	—
Joists	8 5 0	—
Heavy Rails	8 10 0	—
Fish-plates	12 15 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	9 0 0	—
Soft Billets	7 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 15 0†	—
Light ,,	9 0 0 to 9 5 0	
Billets	8 0 0 to 11 0 0†	
MANCHESTER—		
Bars (Round)	9 0 0 to 10 0 0	
,, (others)	8 10 0 to 9 0 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	13 15 0	13 10 0
Plates	9 0 0	—
,, (Lancs. Boiler)	12 10 0	—
SHEFFIELD—		
Siemens Acid Billets	11 0 0	—
Bessemer Billets	12 0 0	—
Hard Basic	9 0 0 to 9 5 0	
Intermediate Basic	8 0 0 to 8 15 0	
Soft Basic	7 15 0	—
Hoops	12 0 0	—
Soft Wire Rods	9 10 0 to 11 0 0	
MIDLANDS—		
Small Rolled Bars	8 15 0	—
Billets and Sheet-bars	6 15 0 to 7 0 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	16 10 0 to 16 15 0	
Angles	8 7 6 to 8 15 0	
Joists	8 7 6 to 8 15 0	
Tees	9 7 6 to 9 15 0	
Bridge and Tank Plates	9 0 0 to 9 5 0	
Boiler Plates	13 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	19/6 to 19/9
Block Tin (cash)	252 5 0
,, (three months)	254 7 6
Copper (cash)	59 17 6
,, (three months)	60 17 6
Spanish Lead (cash)	33 7 6
,, (three months)	32 15 0
Spelter (cash)	34 5 0
,, (three months)	33 10 0
MANCHESTER—	
Copper, Best Selected Ingots	63 10 0
,, Electrolytic	64 10 0
,, Strong Sheets	90 0 0
,, Tubes (Basis Price)	0 1 1
Brass Tubes (Basis price)	0 0 11½
,, Condenser	0 1 2
Lead, English	35 15 0
,, Foreign	34 10 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8 to 1/9 per lb.	
Ferro Tungsten	1/5 to 1/6 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24 0 0	8/-
,, 6 p.c. to 8 p.c. ,,	£23 5 0	7/9
,, 8 p.c. to 10 p.c. ,,	£23 0 0	7/6
,, Specially Refined		
,, MAX. 2 p.c. carbon	£43 0 0	15/6
,, ,, 1 p.c. ,,	£52 0 0	17/-
,, ,, 0.70 p.c. carbon	£57 10 0	19/-
,, ,, carbon free	1/5 per lb.	
Metallic Chromium	4/- per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- per unit	
,, ,, 75 p.c.	£22 10 0 scale 6/- per unit	
,, Vanadium	16/- per lb	
,, Molybdenum	7/- per lb.	
,, Titanium (carbon free)	1/- per lb.	
Nickel (per ton)	£175	
Cobalt	10/3 per lb.	
Aluminium (per ton)	£130	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	14/3
,, ,, Ell	15/-
,, ,, Splint	15/9 to 18/9
,, ,, Trebles	15/-
,, ,, Doubles	14/-
,, ,, Singles	14/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	14/3
,, ,, Splints	15/9
,, ,, Trebles	15/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	13/- to 15/6
Screened Navigation	21/6
Trebles	15/-
Doubles	13/-
Singles	13/3
LOTHIANS—	
(f.o.b. Leith)—Best Steam	14/3
Secondary Steam	13/9
Trebles	14/-
Doubles	13/6
Singles	13/3

ENGLAND.

(8) N.W. COAST—	
Steams	26/-
Household	45/- to 58/4
Coke	28/-
NORTHUMBERLAND—	
Best Steams	16/6 to 17/-
Second Steams	16/3 to 16/6
Steam Smalls	10/6 to 11/9
Unscreened	15/6 to 16/6
Household	23/6 to 25/-
DURHAM—	
Best Gas	16/-
Second	15/6
Household	23/6 to 25/-
Foundry Coke	19/3
SHEFFIELD—	Inland.
Best Hand-picked Branch	30/- to 33/- —
Barnsley Best Silkstone	26/- to 27/- —
Derbyshire Best Brights	23/- to 26/- —
,, ,, House	21/- to 23/- —
,, ,, Large Nuts	17/6 to 20/- —
,, ,, Small	12/- to 14/- —
Yorkshire Hards	17/6 to 21/- —
Derbyshire ,,	17/6 to 21/- —
Rough Slacks	10/- to 12/6 —
Nutty ,,	8/6 to 10/- —
Smalls	3/6 to 5/6 —
Blast-furnace Coke (Inland)*	— —
,, ,, (Export)	f.o.b. 16/- to 16/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	25/6 to 26/-
Second ,, ,,	24/6 to 25/-
Best Dry Large	24/6 to 25/-
Ordinary Dry Large	23/- to 24/-
Best Black Vein Large	24/- to 24/6
Western Valley ,,	23/6 to 24/-
Best Eastern Valley Large	23/- to 24/-
Ordinary ,, ,,	22/6 to 23/-
Best Steam Smalls	14/- to 15/-
Ordinary ,,	13/- to 14/-
Washed Nuts	20/- to 27/6
No. 3 Rhondda Large	26/6 to 27/-
,, ,, Smalls	16/6 to 17/-
No. 2 ,, Large	21/- to 22/-
,, ,, Through	18/- to 20/-
,, ,, Smalls	11/- to 12/-
Foundry Coke (export)	40/- to 45/-
Furnace Coke (export)	28/- to 30/-
Patent Fuel	22/- to 26/-
Pitwood (ex ship)	29/- to 30/-
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	40/- to 42/6
Seconds	32/6 to 37/6
Red Vein	27/- to 30/-
Machine-made Cobbles	50/- to 52/6
Nuts	50/- to 54/-
Beans	32/6 to 36/-
Peas	21/- to 23/-
Breaker Duff	7/9 to 8/3
Rubbly Culm	12/- to 12/6
Steam Coals:	
Large	21/- to 24/-
Seconds	20/- to 21/-
Smalls	10/- to 13/-
Cargo Through	16/- to 19/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. * For blast-furnaces only, 16/6, with fluctuations according to analysis; open market, 16/6 to 18/- at ovens. † Latest quotations available. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

Engineering Outlook.

THE only thing that offers hope of a temporary improvement in the iron, steel and engineering trades is the strike in the Charleroi district, which threatens to extend to other metallurgical centres in Belgium, and it is believed that if the dispute is not settled shortly it will have the effect of diverting business to this country. There has certainly been a little more activity in some departments, but makers do not attach much importance to this slight recovery, which can hardly be maintained in view of the collapse that is taking place in the economic situation generally. Great efforts nevertheless continue to be made to profit from the falling franc to sell iron and steel abroad, and a significant feature is the success of Messrs. Schneider et Cie., of Creusot, who, in the face of severe competition, have secured a contract from Egypt for the supply of five locomotives and tenders. This is the first time that Egypt has purchased locomotives in France since 1910. Another incident showing the trend of events is the Italian protest against the French prohibition of scrap iron exports. Until recently the prohibition applied to all countries except Italy, which has been taking increasing quantities of scrap iron until the total for last year reached 300,000 tons. In view of the commercial arrangements being come to with other countries, an exception can no longer be made in favour of Italy, and it has therefore been decided to limit the yearly total of exports to 300,000 tons, the amount allotted to Italy being 10,000 tons.

Forestry and Engineering.

So far as the destruction of forests influences climate, the development of a vast timber industry in Africa may very well affect the engineering problems that will have to be dealt with in the future. According to M. Maurice Mangin, Inspector of Forests, who has recently returned from a mission in French West Africa, the havoc being wrought in the accessible forests in the Senegal, Mauretania, Sahel, and the French Sudan is having so serious an effect upon the climatic conditions that something will have to be done to replace the trees which are being cut down. M. Mangin declares that the destruction of the forests is disturbing the equilibrium of the elements which determine climate and is seriously compromising the future of colonial agriculture. There is a much less rainfall than formerly and a more frequent flooding of rivers, while the desert area is steadily extending southwards. While not discouraging the attempts to develop a valuable colonial timber industry, he declares that West Africa can only be saved from becoming a barren waste by making afforestation a necessary complement to the timber trade.

Foreign Trade.

The returns of foreign trade during the first five months of the year again show curious discrepancies in values and tonnage as compared with the totals for the similar period of 1924. The total value of imports was 15,845 million francs, a decrease of more than 827 million francs, the only improvement being in manufactured goods, which amounted to 2178 million francs. The value of exports was returned as 18,117 million francs, a diminution of 241 million francs. This contraction was due entirely to foodstuffs, for there was an increase alike in the exports of raw material and of manufactured goods, the latter amounting to no less than 10,906 million francs. This figure exceeded the value of raw material imports. In tonnage there was an all-round contraction of imports which totalled 18,918,055 tons for the five months, or 4,608,759 tons less than in the corresponding period of last year. The exports totalled 12,609,321 tons, an increase of 1,366,430 tons, which was almost entirely due to raw material, the total of which was 10,489,387 tons. Manufactured goods also improved to 1,577,585 tons, or nearly three times more than the imports. Nevertheless, the values of imports of manufactured goods increased to a far greater extent than the exports, thereby implying that they were influenced by the exchange rate in the case of imports, while a considerable amount of selling must have taken place abroad at lower prices.

Maritime Week.

Every year there is held a "maritime week" with a view of stimulating interest in the development of the merchant fleet, and at the recent meeting at Cette prominence was given to the works being carried out on the Etang de Thau upon which the port of Cette is situated. As is the case with the Etang de Berre, which is being turned into a vast industrial centre where chemical factories, oil refineries, shipbuilding yards and other great enterprises have been created, the establishment of similar works on the Etang de Thau will give considerable importance to Cette. The Cette canal is to be widened and the canal through the Etang de Thau will be deepened to allow of sea-going vessels penetrating into the lagoon and berthing alongside wharves belonging to the factories.

Nationalisation of Mines.

Although the present Government is morally bound to carry through the extensive Socialist programme of industrial "reforms," it has so far failed to do much more than its predecessors, for while the Socialist majority will readily adopt the measures introduced, it is generally found impossible to put them into effect. The Government has therefore been obliged to relax its efforts to impose an eight hours' day in the merchant marine and to secure control over the railways. It is hardly likely that any better result will attend the efforts to bring about a nationalisation of the coal mines. A Bill to that effect will be introduced shortly and is being condemned by the commercial bodies throughout the country, but if passed it will doubtless share the fate of many other Socialist measures and will be shelved because the country is absolutely opposed to the State embarking upon new industrial enterprises.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

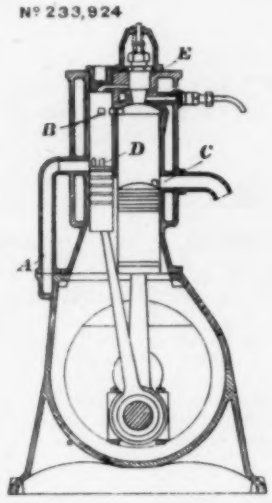
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

233,924. July 9th, 1924.—SCAVENGING PUMPS, M. Gatti, Via S. Maria Valle 3, Milan, Italy.

In this engine each working cylinder is provided with an auxiliary cylinder and the two pistons are connected to the same crank. In the position shown in the drawing scavenging air is free to blow right through the two cylinders, from the supply A, up the auxiliary cylinder, through the ports B and to the exhaust

Nº 233,924



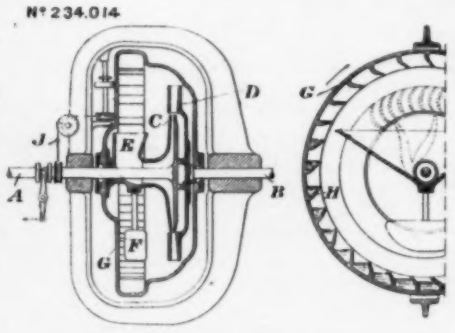
C. When the ports C and D are covered by the pistons compression starts and continues equally in both cylinders until the auxiliary piston covers the ports B. Compression in the auxiliary cylinder is then intensified by the reduction in the volume and provides high-pressure air for spraying the fuel into the working cylinder through the jet E.—*May 21st*, 1925.

TRANSMISSION OF POWER.

234,014. January 13th, 1925.—HYDRAULIC TRANSMISSION, L. Renault, 15, Rue Gustave Sandoz, Billancourt (Seine), France.

It is claimed that with this hydraulic transmission gear the torque produced is, within limits, inversely proportional to the resistance of the driven shaft. The driving shaft is marked A and the driven shaft B. On the driving shaft there is fixed an

Nº 234,014



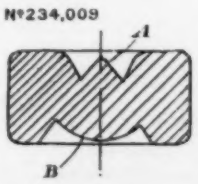
impeller C which delivers jets of liquid on to the bladed wheel D on the driven shaft. The inlet of the impeller is extended as a hopper E, which is loose on the shaft and is held in an upright position by the counterweight F. The casing G is provided with buckets H and is rotated by the gearing J so that it constantly replenishes the supply of liquid to the hopper and impeller.—*May 21st*, 1925.

MEASURING AND TESTING INSTRUMENTS.

234,009. December 30th, 1924.—WATER LEVEL GAUGES, R. Boizard, 10, Rue Commines, Paris, France.

The object of this invention is to make the water level more easily readable, and for this reason the inside face of the glass is

Nº 234,009



provided with a prismatic rib A, while the outside is formed with a convex or lens-shaped face B. The essential feature is the arrangement of both these faces below the general surface of the glass, so that the edges, where the water-tight joint is made, can be readily trued up.—*May 21st*, 1925.

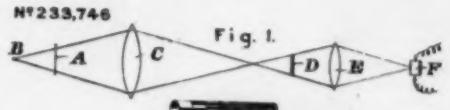
TELEGRAPHS AND TELEPHONES.

233,746. January 15th, 1924.—TELEVISION, E. E. F. d'Albe, The Hermitage, Portsmouth-road, Kingston-on-Thames.

According to this scheme for the transmission of pictures the image A is illuminated by a source of light B and after passing a condenser C is transmitted through a filter D and lens E on to a silenium cell F. A detail of the filter D is given in Fig. 2, from which it will be seen that it comprises a series of

Nº 233,746

Fig. 1.



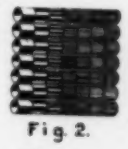
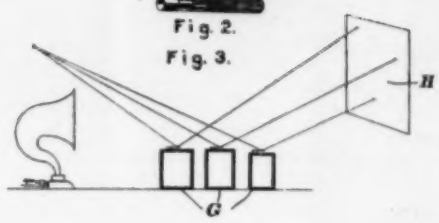


Fig. 2.

Fig. 3.



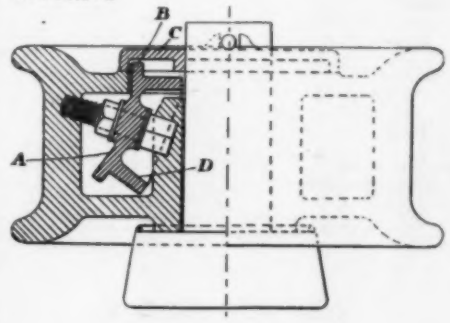
cylinders partly opaque and partly transparent, all rotated at different speeds. The resultant medley of sounds produced in the selenium cell is transmitted to the distant station by any convenient means and is reproduced in a "loud speaker" as shown in Fig. 3. The sound vibrations of the loud speaker produce sympathetic vibrations in a bank of resonators G illuminated from a source of light and a corresponding image is produced on the screen H.—*May 15th*, 1925.

MINING MACHINERY.

233,972. October 17th, 1924.—A SELF-LUBRICATING HAULAGE PULLEY, R. Aytoun, 184, High-street, Dalkeith, Scotland.

The lubrication of this guide pulley is effected by one or more small wheels A arranged in a cavity in the wheel and cast in place.

Nº 233,972



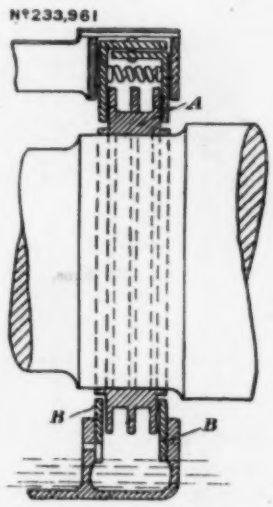
The periphery of the wheel is provided with teeth B that mesh with teeth cast on the underside of the cover plate C. The skirt D of the wheel picks up oil from the cavity of the wheel and delivers it to the top of the bearing pin.—*May 21st*, 1925.

TRAMWAYS AND RAILWAYS.

233,961. September 23rd, 1924.—OIL-RETAINING DEVICES, *H. A. Gill*, 51–52, *Chancery-lane, London, W.C.* 2.

This invention is concerned with the prevention of oil creeping along the axles of railway wagons from the axle-boxes. It com-

Nº 233,961



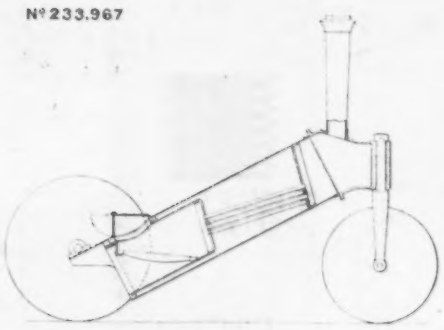
prises a ring A, with one or more grooves, fixed on the axle and running between rings B B attached to the axle-box. It is stipulated that the clearance between the edges of the ring A and the faces of the rings B B shall be such that "the narrow

space will be bridged by the oil which collects at the periphery of the walls of the grooves due to centrifugal action so as to form a gutter which conducts any additional oil over the inner surface of the bearing casing or packing shields into an oil container."—*May* 21*st*, 1925.

MOTOR CARS AND ROAD TRAFFIC.

233,967. October 3rd, 1924.—STEAM TRACTOR BOILERS, A. Wallis, Wallberry, Cromwell-road, Basingstoke.

This boiler is intended for road rollers and tractors and is

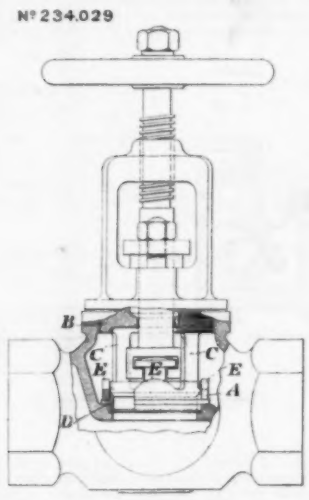


claimed to be cheaper in construction than usual forms. Its design is so obvious in the drawing that no description is required.—*May* 21*st*, 1925.

MISCELLANEOUS.

234,029. February 27th, 1925.—SCREW-DOWN VALVES, R. A. Hopkinson and J. Hopkinson and Co., Ltd., Britannia Works, Huddersfield.

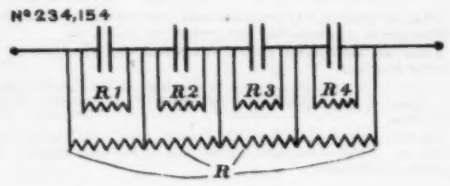
This invention relates to valves of which the seating is held in place in the body by means of a cage-like extension of the bonnet, and is intended to provide a more secure clamping of the seating ring. As illustrated, the cage has the annulus A connected to



the upper portion B by bars or ribs as C. The under surface of the annulus A is made flat, as shown, and abuts upon the valve seat D. But the upper surface of the annulus is arched at E in the bridge-like portions between the bars or ribs C, or is made to such a configuration as will give a varying depth of metal and thus provide a substantially uniform pressure upon the valve seat D over the whole under surface of the annulus.—*May* 21*st*, 1925.

234,154. January 19th, 1924.—IMPROVEMENTS IN AND RELATING TO SMOOTHING CONDENSERS FOR CONTINUOUS-CURRENT CIRCUITS, Norman Lea and Radio Communication Company, Ltd., 34, Norfolk-street, Strand, W.C.

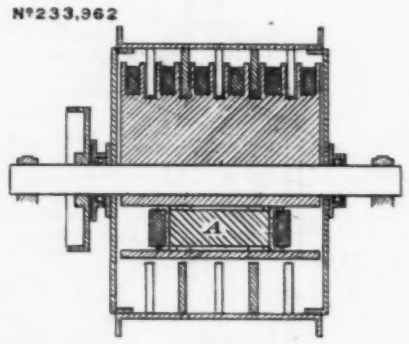
This invention relates to so-called smoothing condensers employed for the purpose of reducing the amount of ripple or other periodic disturbance occurring in electrical circuits, as, for example, in those employed for feeding a thermionic valve oscillator from an alternating-current source. Artificial ohmic leaks or resistances are connected across the separate units of a multiple condenser, with the object of eliminating the effect of variable leakages, and to thus ensure the maintenance of a suitable potential distribution between the units of the condenser under working conditions. For smoothing purposes the steady load introduced into the circuit by these artificial leaks R, which, as shown, are all in series, will not as a rule be objectionable, and it is clear that the leakage to be introduced need only be large as compared with the leakage inside a condenser unit. In the diagram, the internal "accidental" resist-



ances of the condensers are represented by R1, R2, R3, R4. The theory of the idea is described.—*May* 10*th*, 1925.

233,962. September 24th, 1924.—MAGNETIC SEPARATORS, B. Wilden, Takusstrasse 95, Bikendorf, Cologne, Germany.

With this separator the magnetic material is not merely allowed to drop off as the field diminishes in intensity, but is actually repelled by a sudden change in the polarity of the field. The repulsion is effected by the passage of a series of pairs of electro-magnets, each pair of which has normally a north and a south pole, in front of another electro-magnet which is sufficiently



powerful to neutralise the magnetism in the pairs of poles and to cause all the poles of those pairs to become of the same sign. The neutralising magnet A is arranged at the point at which it is desired to discharge the particles of magnetic material, which have been picked up by the separator, and the effect of making the pairs of poles of the same polarity is to repel those particles from the poles and to eject them from the machine.—*May* 21*st*, 1925.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

ESCHER WYSS AND CO. S.A., of Zurich, ask us to announce that they have opened offices at 74, Bath-street, Glasgow, C. 2.

PERRIN'S LIMITED asks us to announce that on June 29th it is moving its offices from 15, Catherine-street, London, W.C. 2, to Astor House, Aldwych, London, W.C. 2.

WE are asked to state that Mr. Thomas Fender has, on medical advice, retired from active service with Vickers Ltd., but that he will retain his position as Special Director, to which he was appointed in 1919, for a further period of two years in order that the board may have the benefit of his expert advice.

THE Export Credits Department of the Department of Overseas Trade will remove on Monday, the 29th inst., from 73, Basinghall-street, E.C. 2, to 30-31, King-street, Cheapside, E.C. 2. The present telephone number (London Wall 4713) and telegraphic address ("Exportcred") will remain unchanged.

GEORGE KENT, Ltd., informs us that it has decided to transfer its sales branch from 199-201, High Holborn, London, W.C. 1, to Luton, and asks that all correspondence should be addressed to it at Biscot-road, Luton, as from July 1st next. At the present London office there will be a small staff and one of the directors will always be in attendance.

THE Air Ministry announces that Sir Samuel Hoare, Secretary of State for Air, and Sir Philip Sassoon, Under-Secretary of State for Air, with their personal staffs, have removed their offices from Adastral House, Kingsway, to Gwydyr House, Whitehall, which will in future be their official address. The Air Ministry as a whole remains at Adastral House.

MODEL FORM OF GENERAL CONDITIONS OF CONTRACT (EXPORT)—The Institution of Electrical Engineers has issued the two following additional sets of Model Conditions of Contract for the supply of plant and materials (excluding cables) and the execution of work connected therewith:—B1. Conditions recommended for use in connection with export contracts (delivery f.o.b.). B2. Conditions recommended for use in connection with export contracts (including complete erection or supervision of erection). Copies of each may be obtained from the Secretary of the Institution, Savoy-place, Victoria Embankment, London, W.C. 2; or from the publishers, E. and F. N. Spon, Ltd., 57, Haymarket, London, S.W. 1, at one shilling per copy post free.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

PHYSICAL SOCIETY OF LONDON.—Imperial College of Science, South Kensington, S.W. 1. Papers, "The Electrostatic Capacity of Two Spheres when Touching One Another," by Dr. Alexander Russell, F.R.S.; "An Investigation of the Control Conditions under which Newton's Law is Valid for the Emission of Heat from Electrically Heated Wires," by Miss S. Marshall and Mr. J. O. C. Vick; "Condensation Nuclei Produced by the Illumination of Air-Halogen Mixtures," by Mr. Ivor Jones. 5 p.m.

SATURDAY, JUNE 27TH.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS.—The Lecture Theatre of the Institute, Newcastle-upon-Tyne. Papers: "A Few Notes on the 'Safety First' Movement," by Mr. Paul S. Lea; and "The Scientific Control of Coal Washing by the Combined Application of Ash Characteristic Curves and X-ray Examination," by Mr. J. Leslie Thomson. 2.30 p.m.

MONDAY, JUNE 29TH.

MANCHESTER GEOLOGICAL AND MINING SOCIETY.—Visit to the Preesall Salt Mines near Fleetwood. Train leaves Manchester (Victoria Station) 8.45 a.m.

TUESDAY, JUNE 30TH, AND THURSDAY TO SATURDAY, JULY 2ND TO 4TH.

INSTITUTION OF WATER ENGINEERS.—Thirtieth summer general meeting. For programme see page 719.

WEDNESDAY, JULY 1ST.

BRITISH WATERWORKS ASSOCIATION.—The Council Chamber, the Guildhall, London. Fourteenth annual general meeting.

THURSDAY, JULY 2ND.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the Natural History Museum, Cromwell-road, London, S.W. Conversazione. 8.30 p.m.

TUESDAY TO FRIDAY, JULY 7TH TO 10TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Summer meeting in Newcastle. Paper, "Three-cylinder Simple Locomotives," by Mr. H. N. Gresley, Member of Council.

THURSDAY, JULY 9TH.

DIESEL ENGINE USERS' ASSOCIATION.—Town Hall, Maidenhead. Summer meeting. Notes on "The Working of the Ruston Mechanical Injection Engine," by Mr. C. O. Milton, will be submitted for discussion. Members desiring to see the Ruston mechanical injection engines at the Maidenhead Corporation electricity works can do so earlier in the day. 3 p.m.

SATURDAY, JULY 11TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Town Hall, Westcoe-road, South Shields. North-Eastern District meeting. 11 a.m.

CONTRACTS.

CAMMELL LAIRD AND CO., Ltd., of Birkenhead, have received an order for two steamers from Messrs. Elders and Fyffes for passenger and fruit trade between the West Indies, Central America and Europe.

INTERNATIONAL COMBUSTION, Ltd., announces that information has just been received to the effect that its associated company, International Combustion Engineering Corporation, of New York, U.S.A., has secured the contract for installing a large low temperature distillation plant for the Milwaukee Electric Light and Power Company.

THE VICKERS-SPEARING BOILER COMPANY, Ltd., Bank Buildings, 20, Kingsway, London, W.C. 2, has recently received orders for boilers, &c., from the municipality of Bloemfontein Electricity Supply Department, the Calcutta Corporation Electric Supply Department, the Thames Board Mills, Ltd., Purfleet, the City and County of Bristol Electricity Department, and the Officina San Andres, Chile.

THE WESTINGHOUSE BRAKE AND SAXBY SIGNAL COMPANY, Ltd., has been entrusted by the Metropolitan Railway with the supply and installation of the whole of the apparatus required for re-signalling the Metropolitan widened lines, King's Cross to Moorgate, a stretch of line amounting to approximately 5 miles of running track. The signalling will be of the alternating-current type. The same firm has also received an order for electro-pneumatic decking plant for No. 3 pit top at the Llanbradach colliery of the Cardiff Collieries, Ltd.

IT is officially announced by the Great Western Railway Company that the following contracts have been placed:—(1) Overhaul of dredger Countess: Harris Bros., Ltd., Cambrian Dry Docks, Swansea; (2) annual overhaul and Board of Trade survey of ss. Great Western: Cammell Laird and Co., Ltd., Birkenhead; (3) overhaul of steam tug Pen Cw: Ocean Dry Docks Company, Ltd., Central and Albion Dry Docks, Swansea; (4) overhaul and Board of Trade survey of ss. Sir Richard Grenville: Bickle Engineering Company, Plymouth; (5) provision of hydraulic pumping engine at Port Talbot Docks: East Ferry-road Engineering Works, Ltd., East Ferry-road, Millwall, S.W.; and (6) construction of timber approach gantry at Queen's Dock, Swansea: Purdie, Lumsden and Co., Ltd., 25, Oxford-street, Newcastle-on-Tyne.

END OF VOL. CXXXIX.

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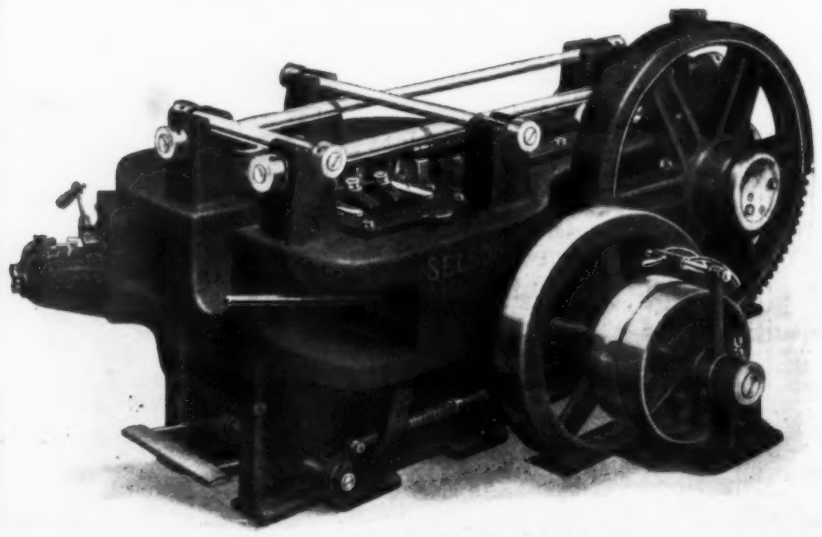

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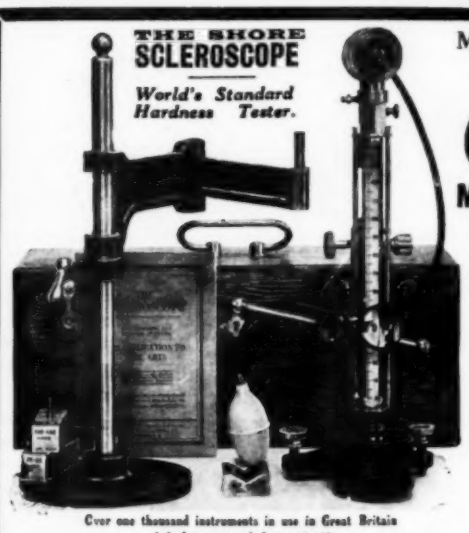

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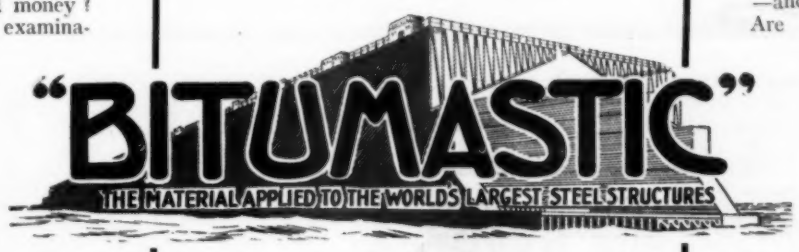

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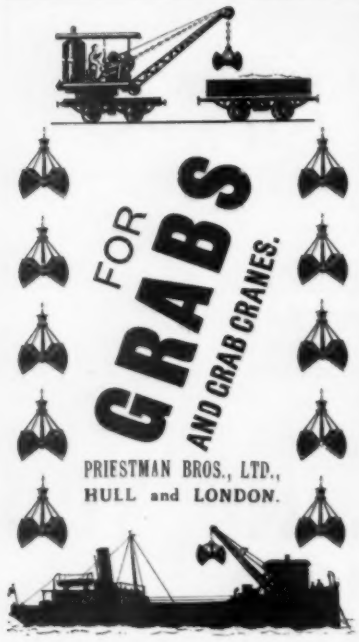

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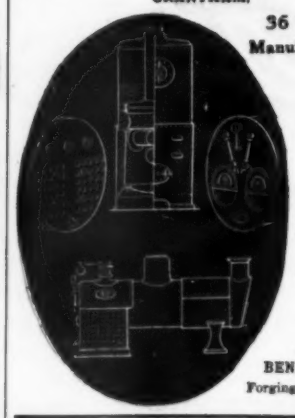

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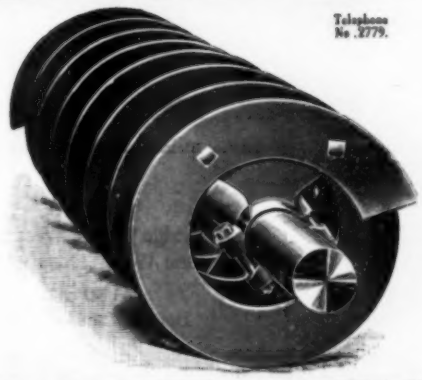

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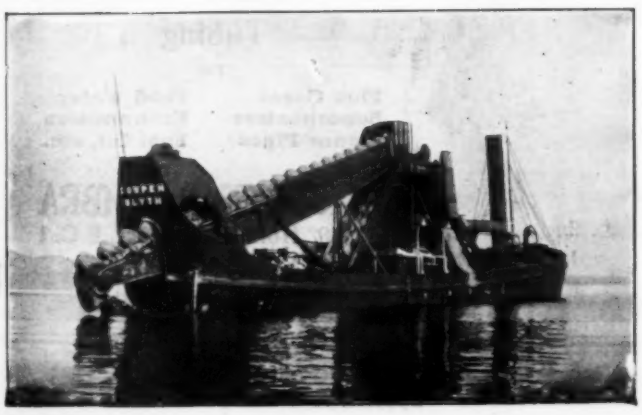

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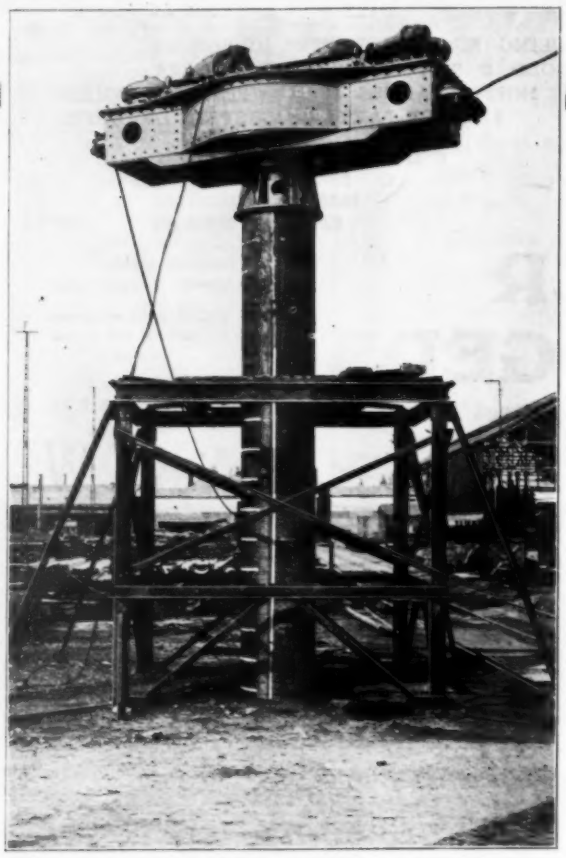

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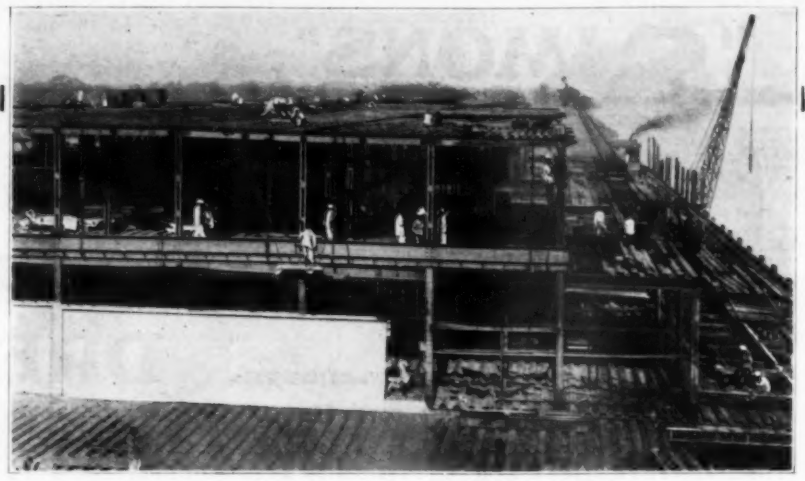

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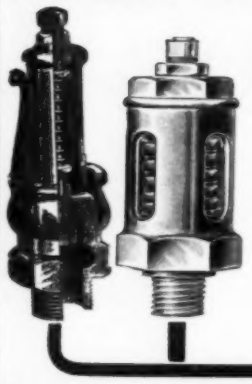

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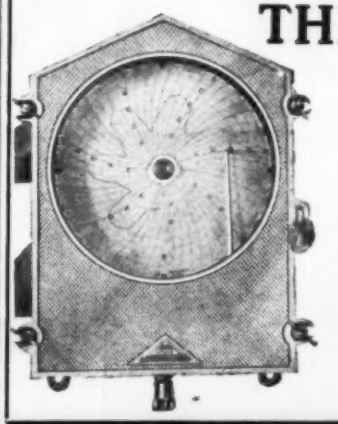

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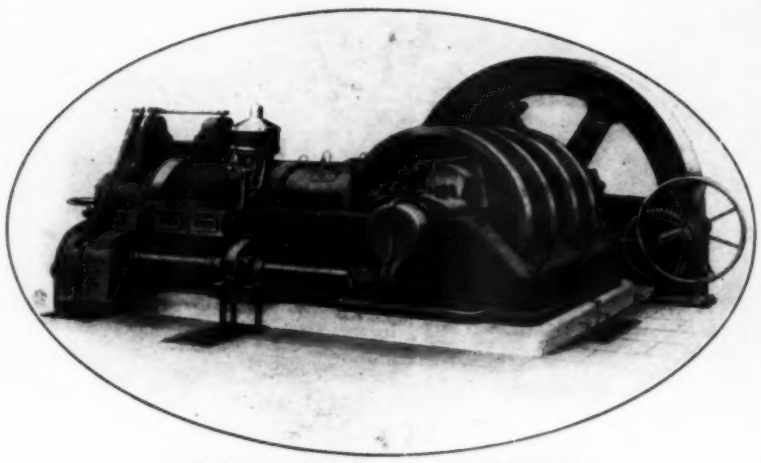

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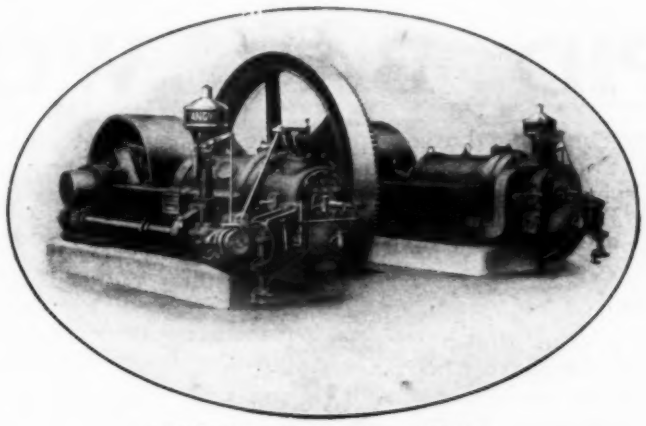
UP TO 500 H.P.



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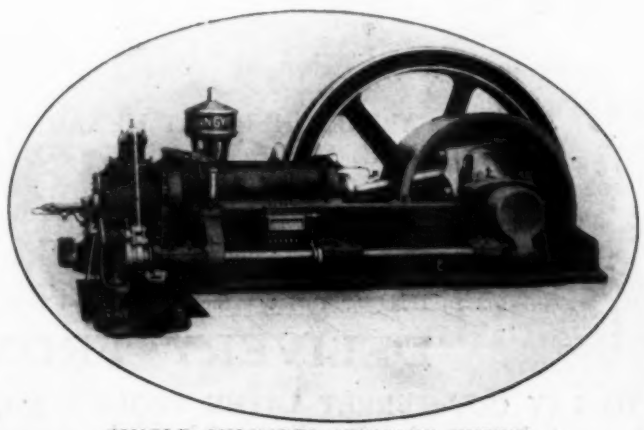

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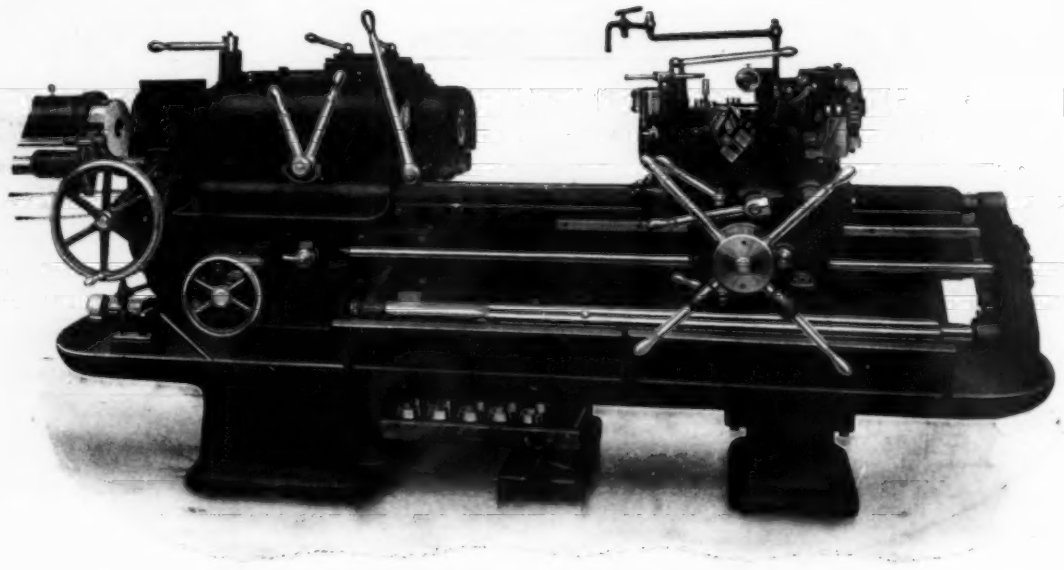

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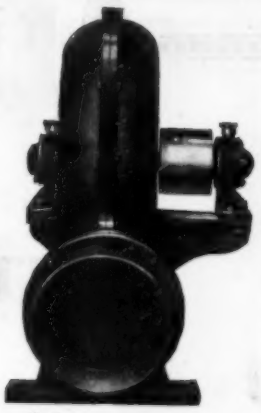

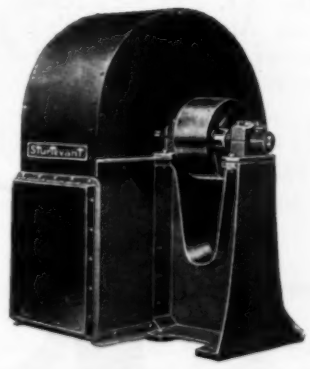

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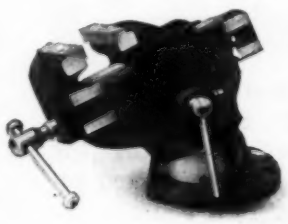

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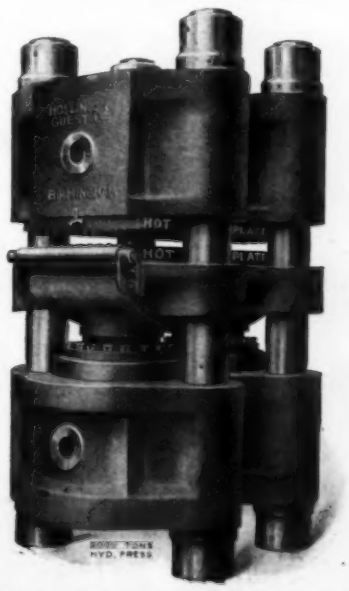

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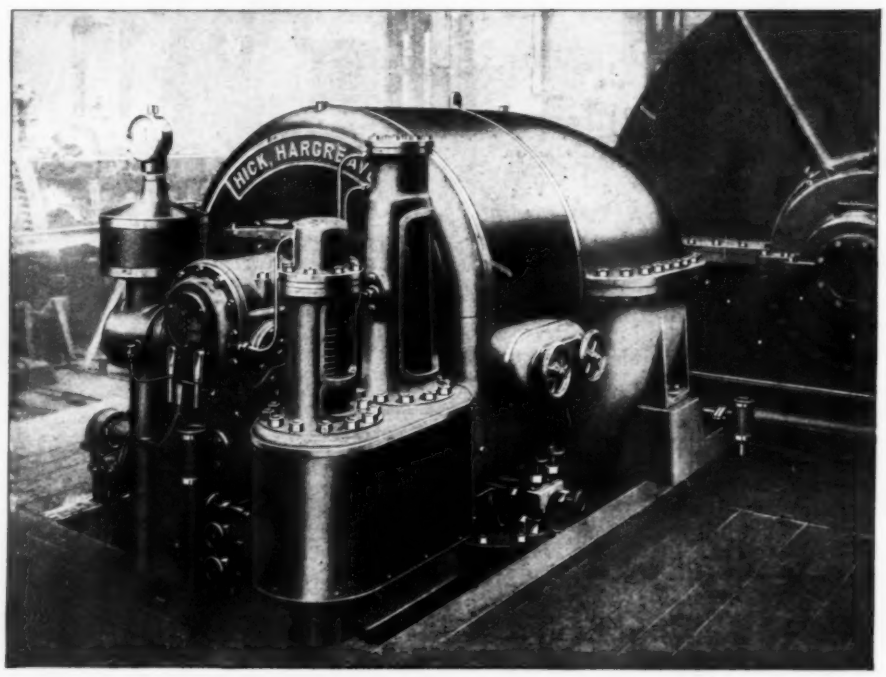

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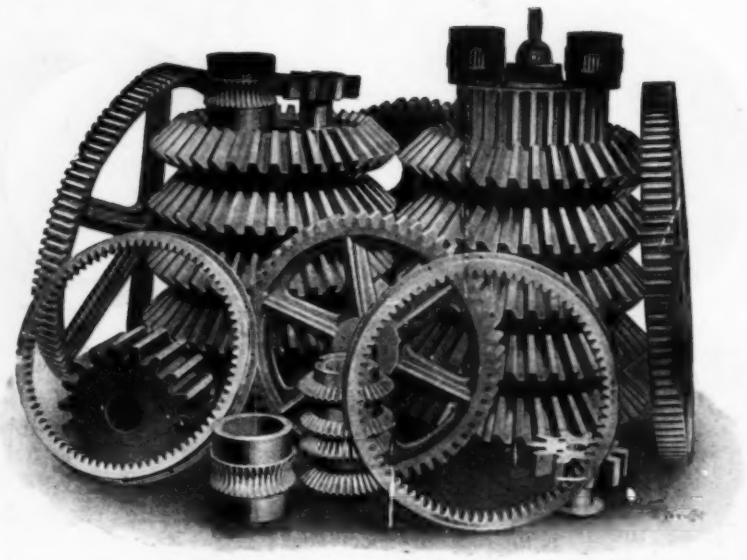

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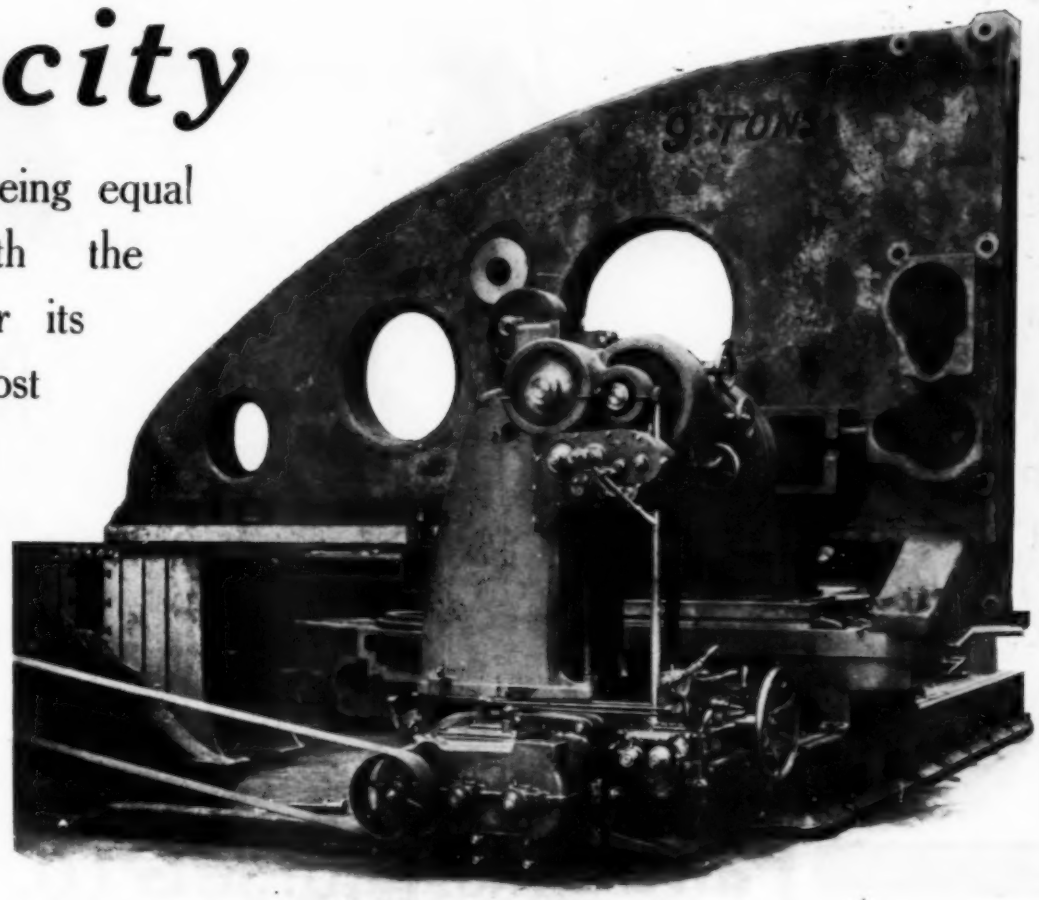

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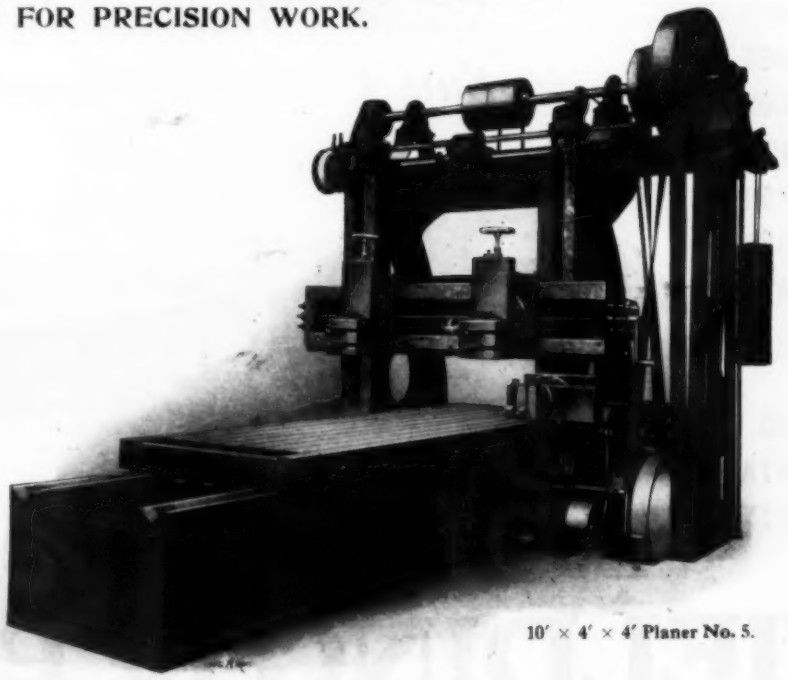

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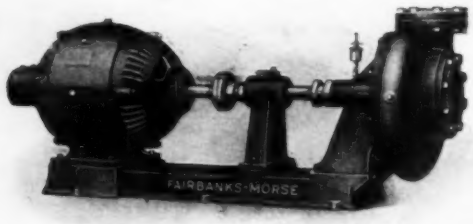

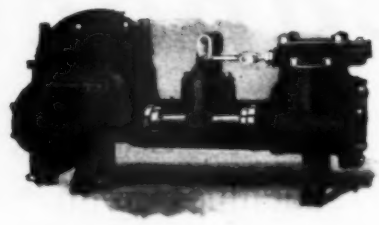

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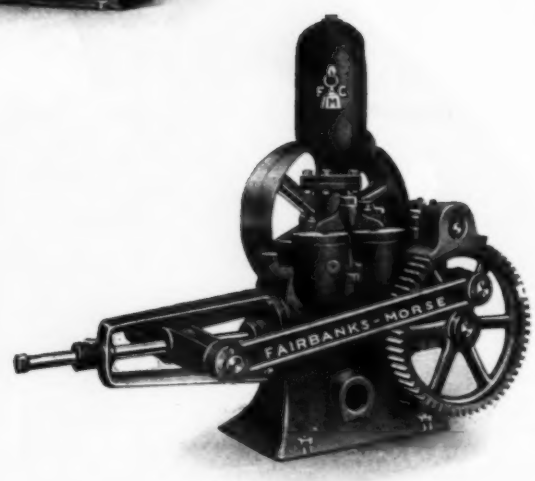

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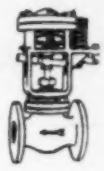

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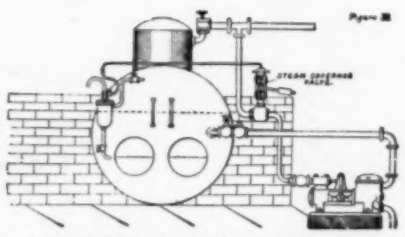

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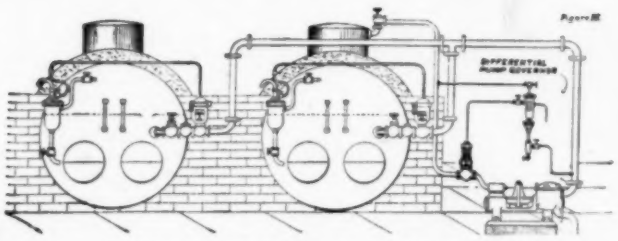

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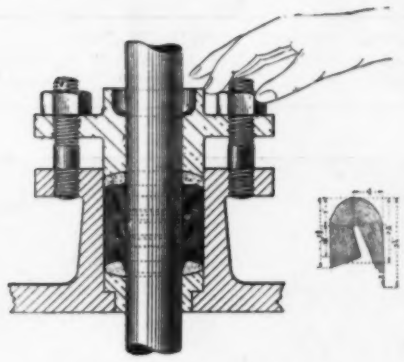

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"During the time it has been installed it has not once let us down and it is most economical to work.

"We have decided to put in a duplicate set and enclose you the order herewith, and trust that you will see that the engine is fixed before Christmas. This is after inspecting and comparing the working costs of six other makers.

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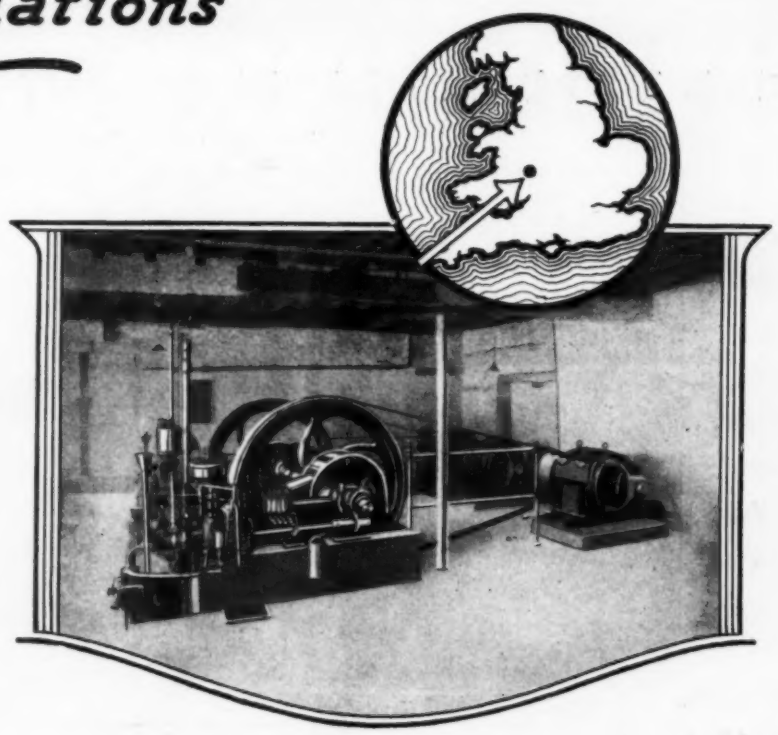

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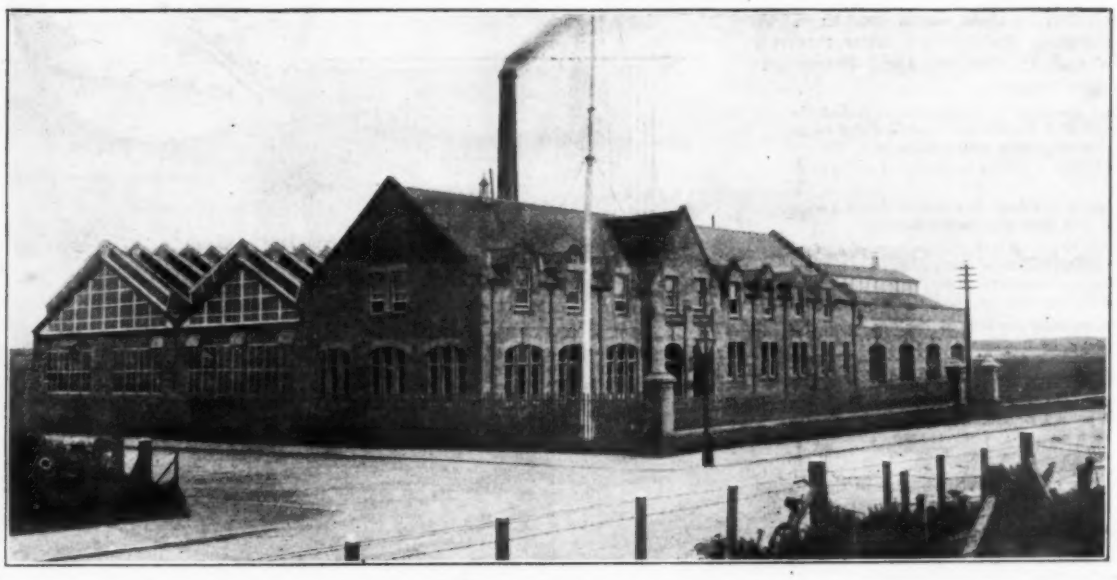

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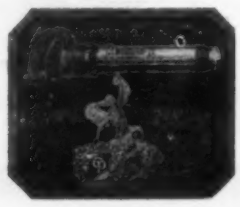

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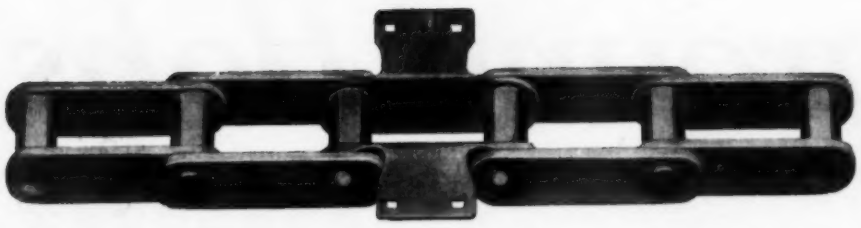

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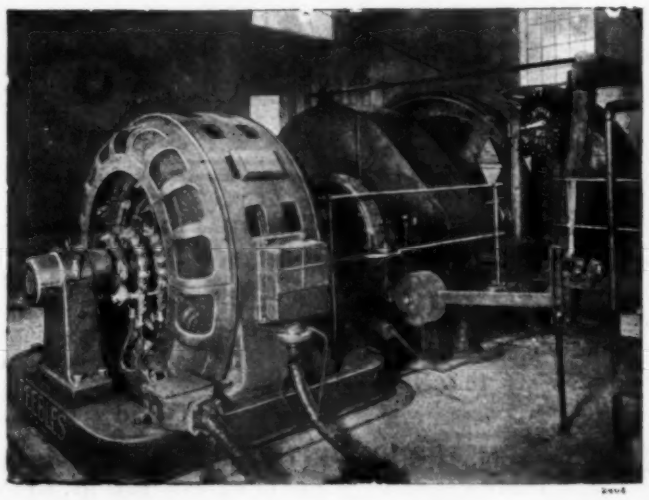

¶ *Illustration shows a 550 b.h.p. 2,750/3,000 volts, 490 r.p.m. Open Type Slip-Ring Induction Motor, driving the Main Winder at a large Colliery in Scotland.*

¶ *The motor is designed to develop peak loads of 750 b.h.p. during accelerating periods which are of a duration of 8 seconds out of every 45 seconds.*

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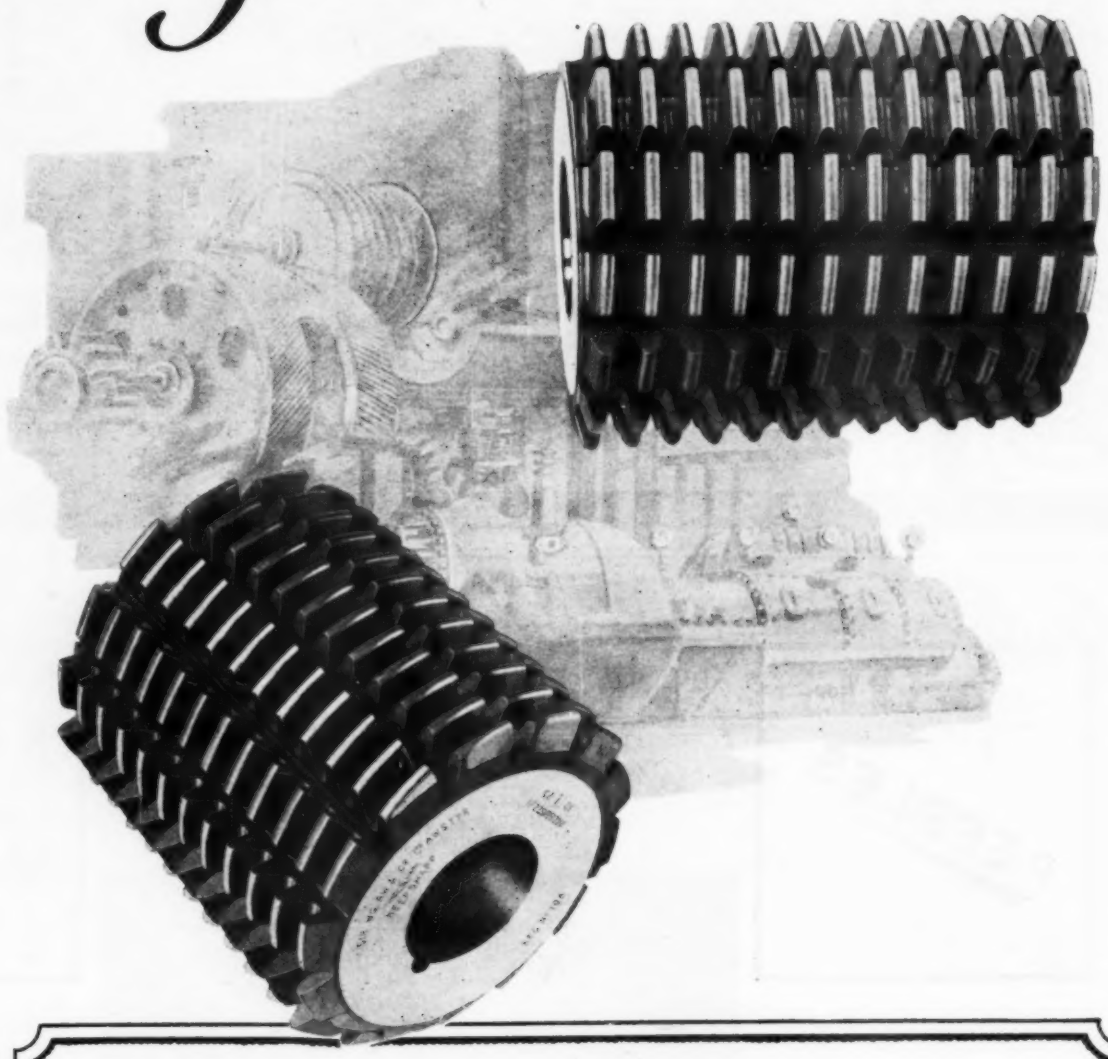
All-ground Hobs



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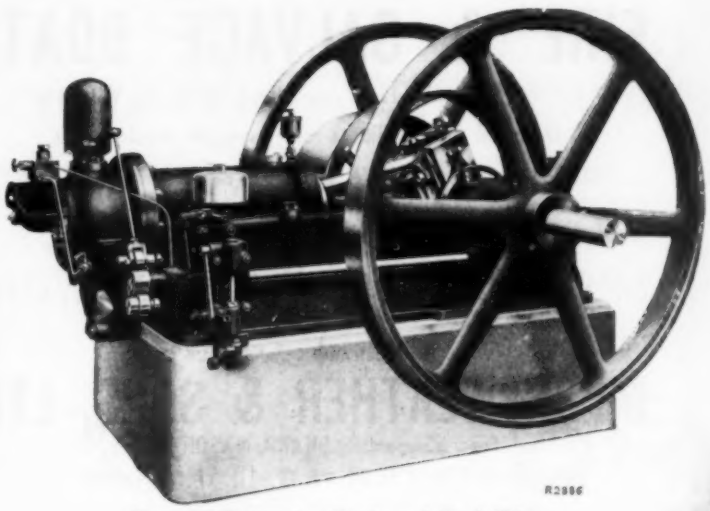

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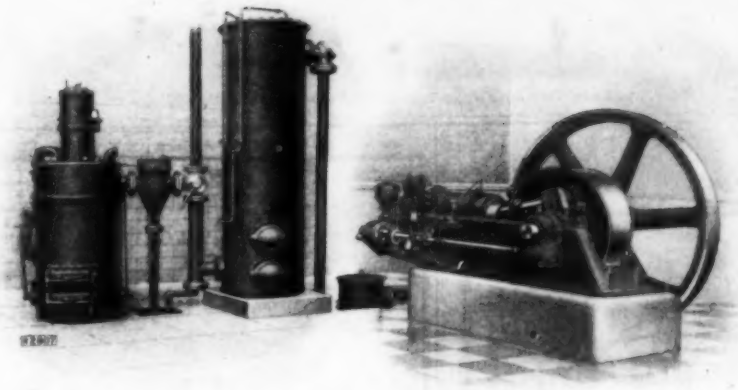

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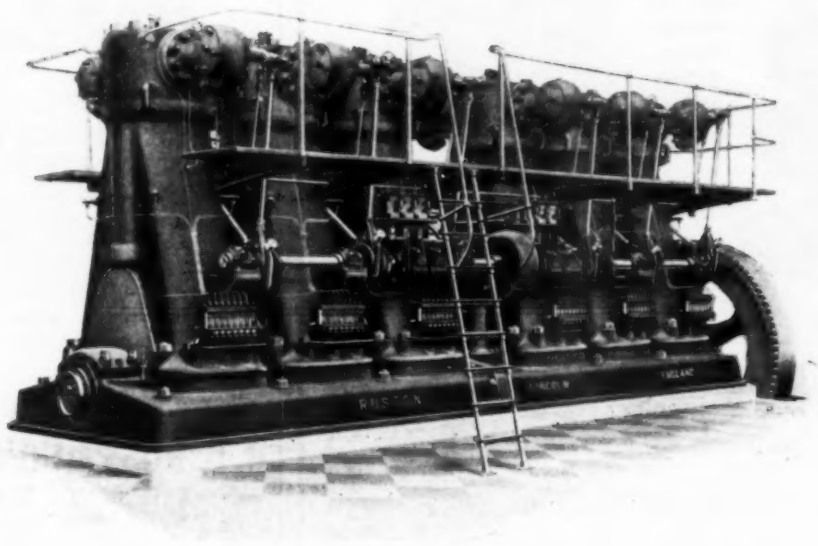

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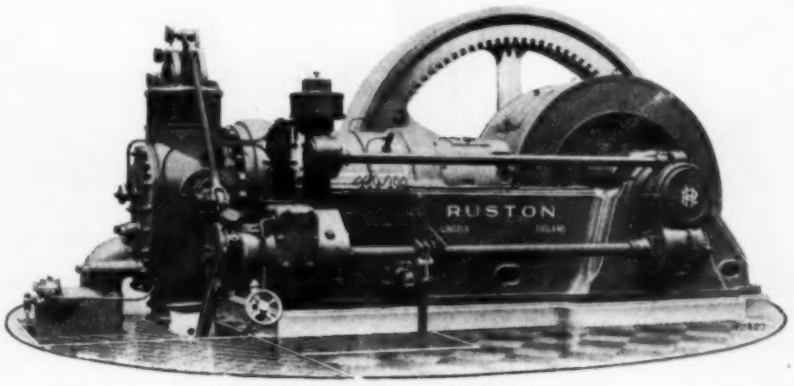

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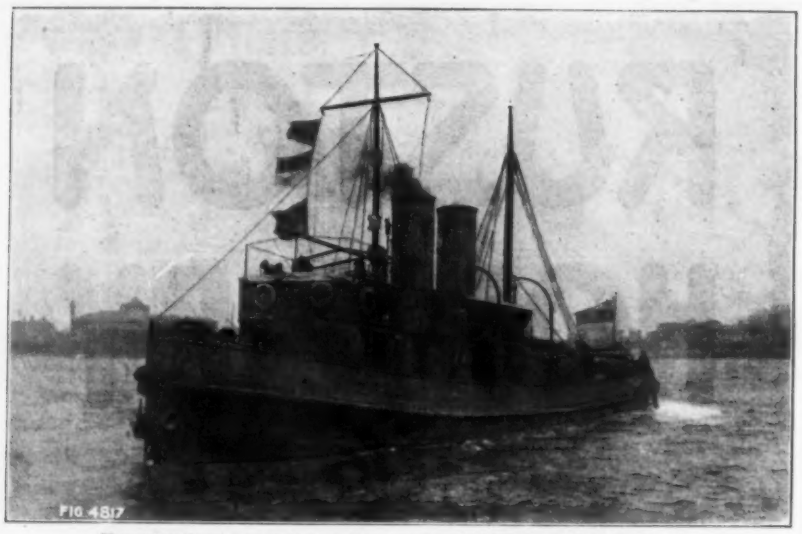

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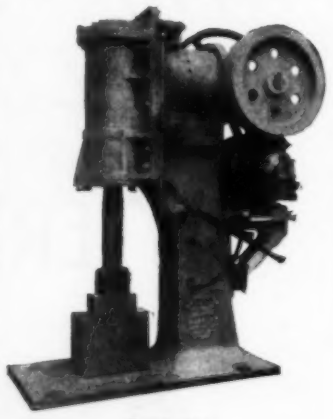

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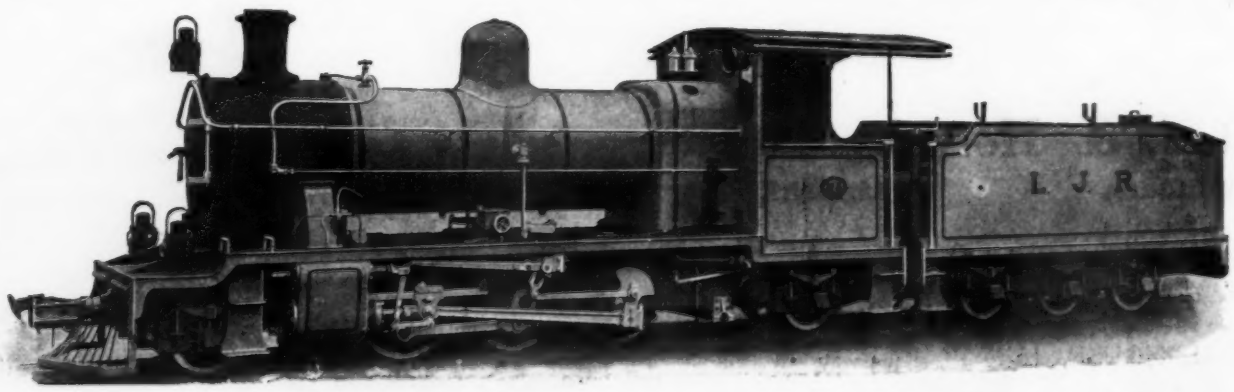

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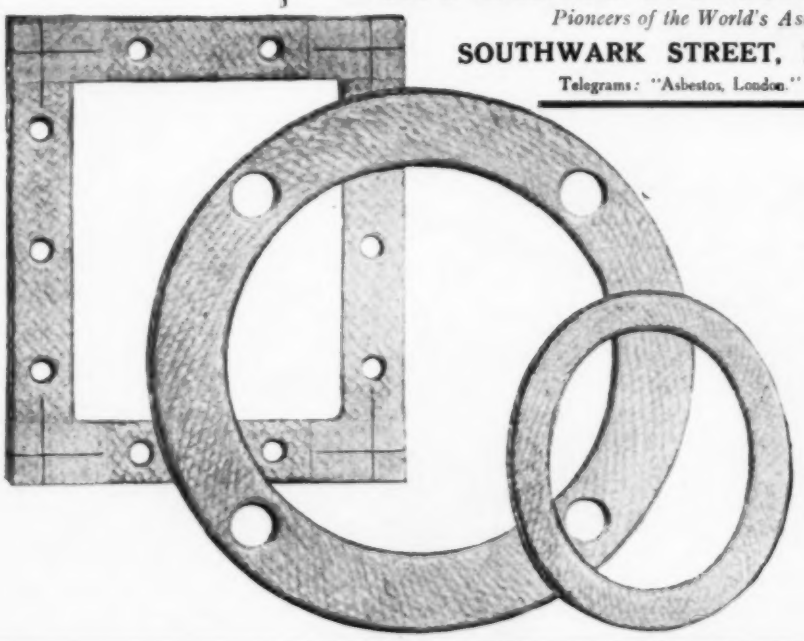

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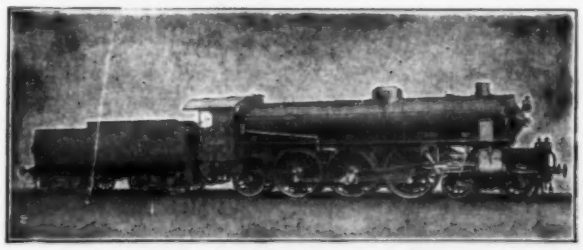

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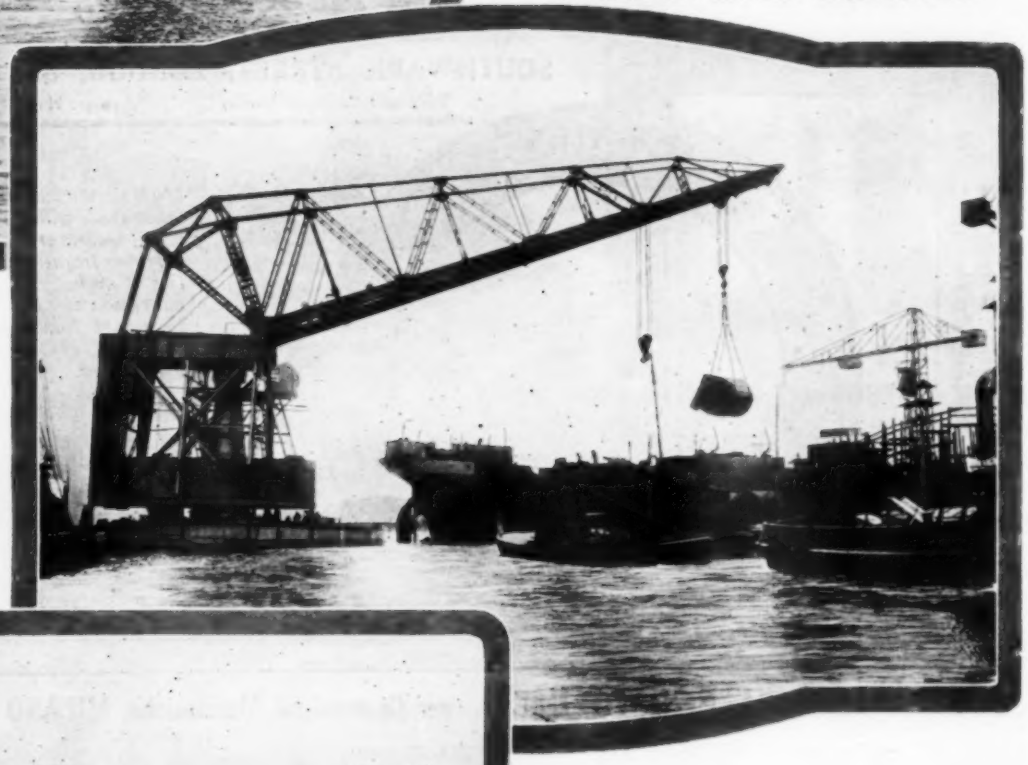

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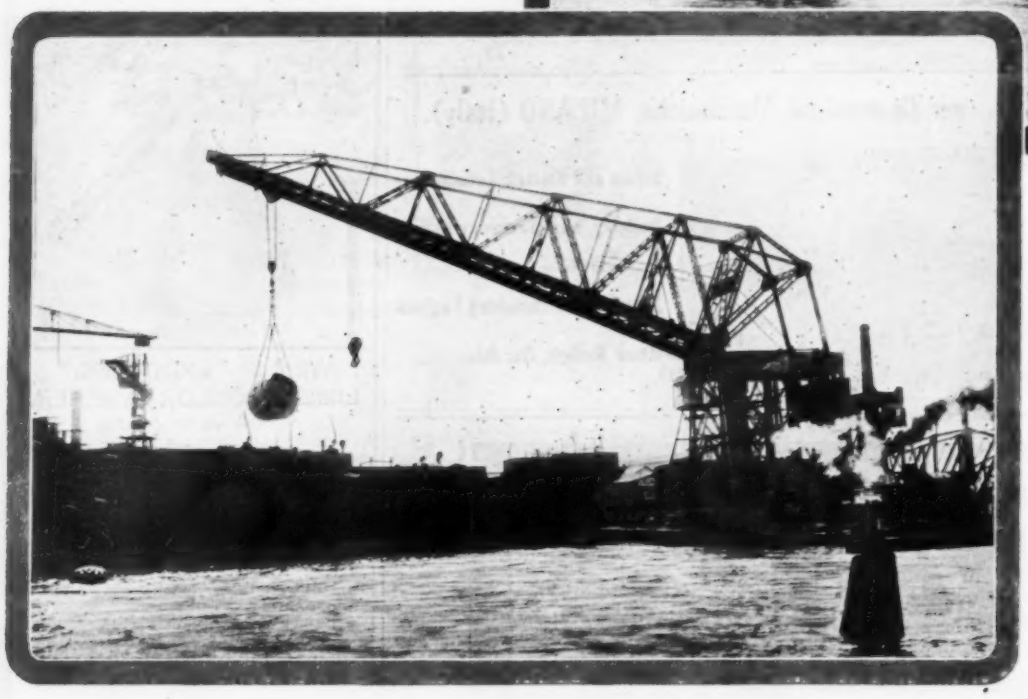

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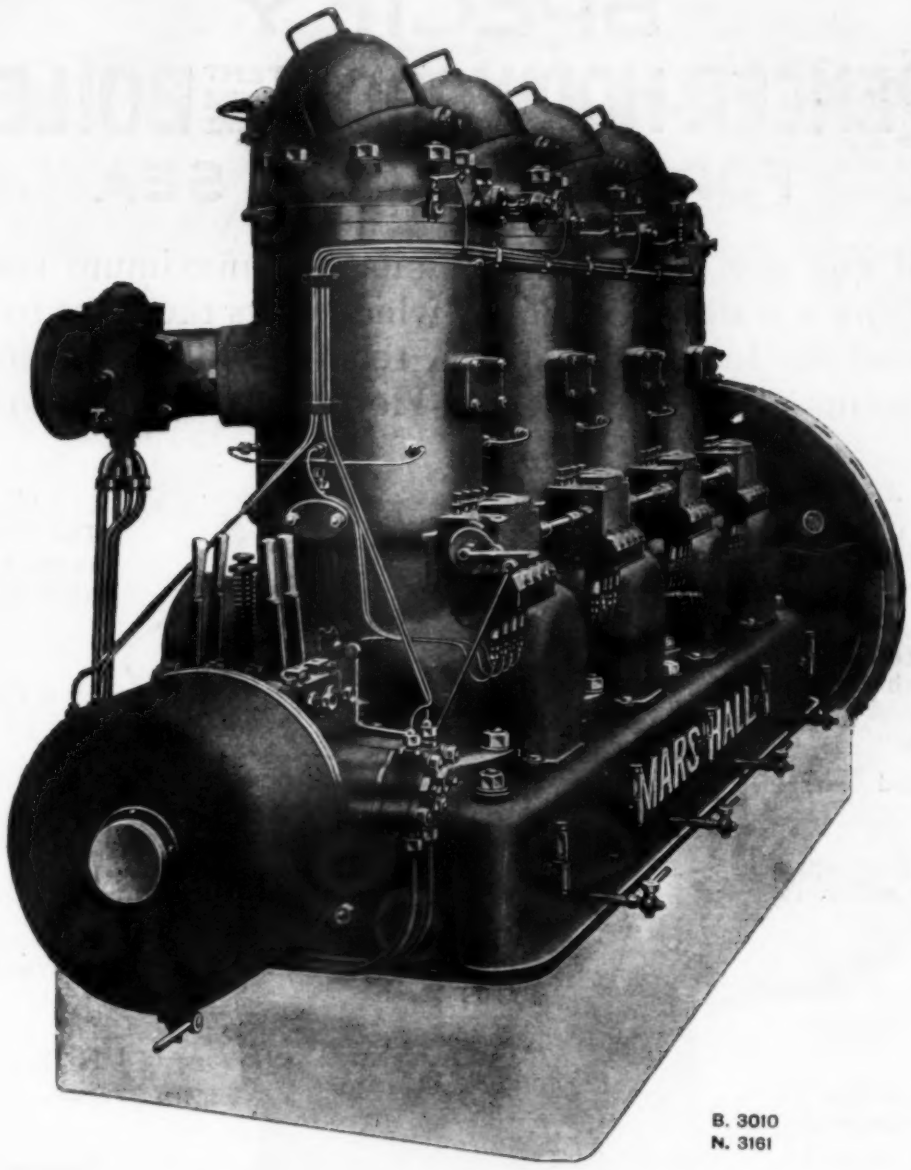

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FOR LAND AND SEA

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II.
Raises steam from cold in HALF AN HOUR day after day without any injurious effects.

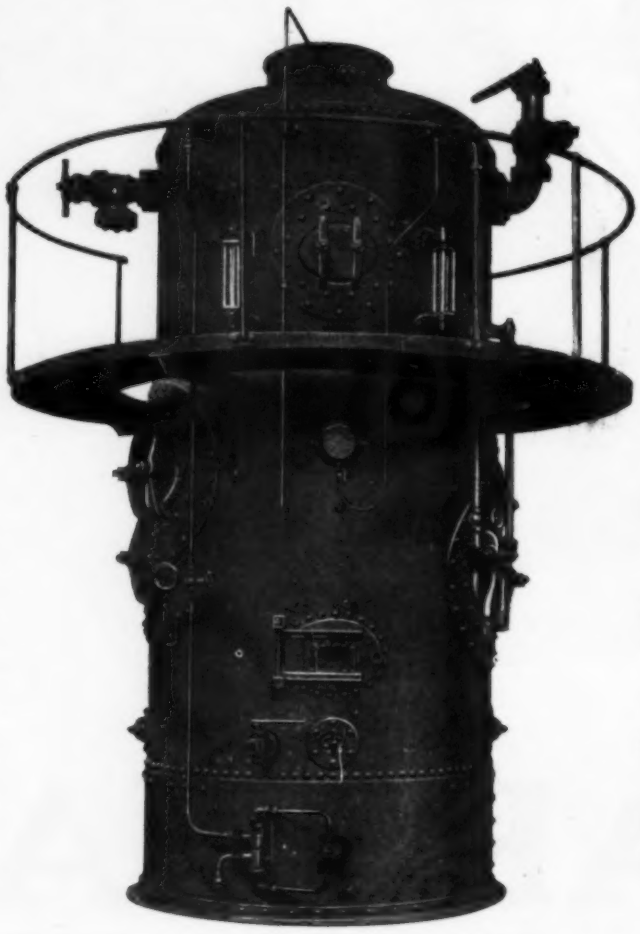
III.
Has no awkward excrescences.

IV.
Occupies less floor space than any other boiler for the same output.

V.
Has no rivet heads subject to high flame temperatures.

VI.
Is the most accessible for cleaning and inspection.

VII.
The tubes are immediately accessible for renewal, inspection, or internal cleaning, by removing the easily-handled mandoors at the side.



VIII.
The tubes can be cleansed an the fire side with a lance while the boiler is working.

IX.
Most Portable.

X.
33 % Overload Capacity.

XI.
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Highest Evaporation for Size.

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Only five feet of Chimney required.

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No. 16. Standard Pattern "Spencer-Hopwood" working on Waterloo Bridge in connection with repairs, May, 1924.

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The leading engine and machine builders of this country specifically recommend or approve the use of Gargoyle Lubricants on the units which they manufacture and sell. They send specific instructions to the purchasers of their equipment recommending the use of these lubricants, and in some cases go so far as to send samples of the products they recommend.

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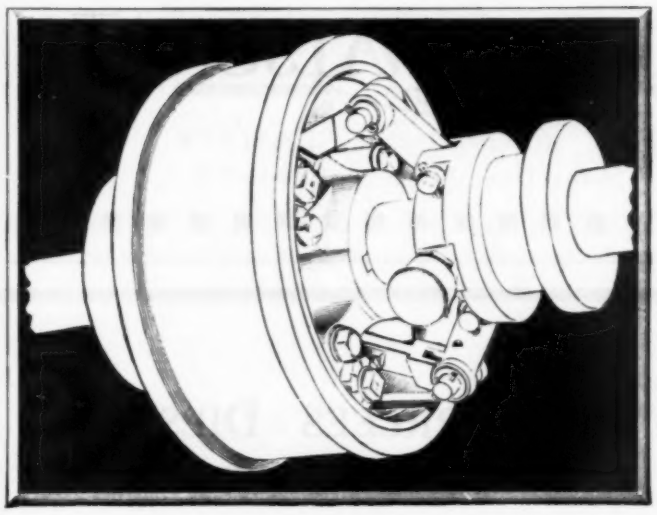

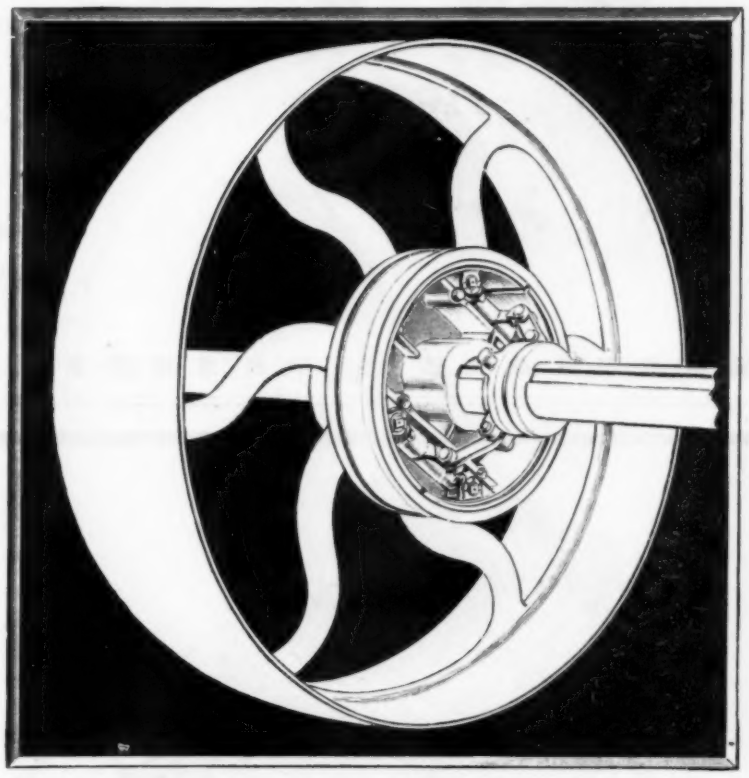

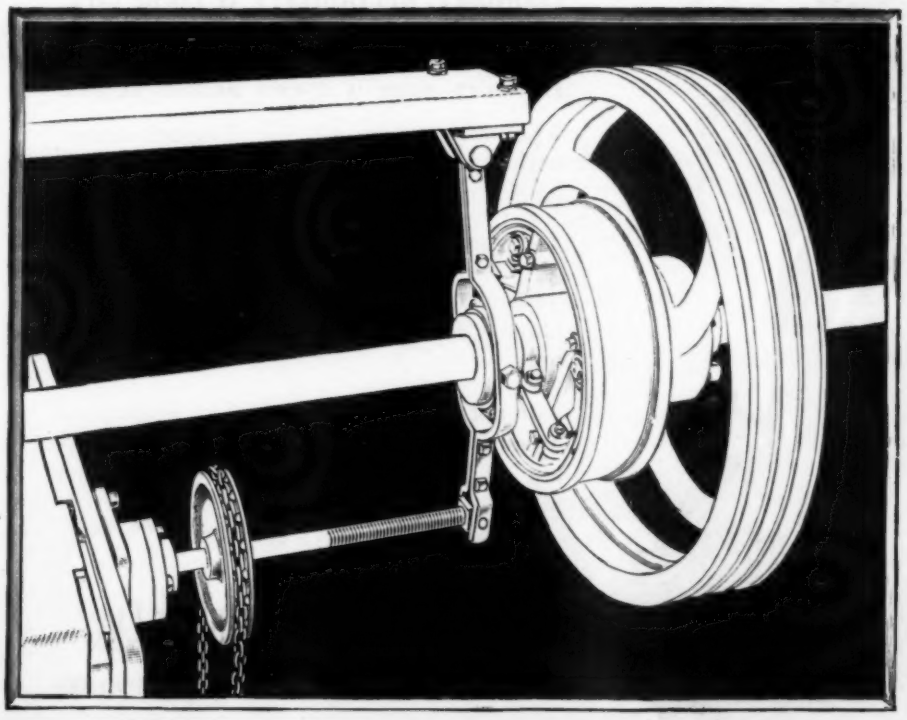

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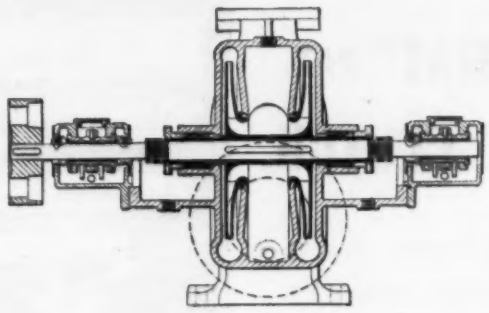

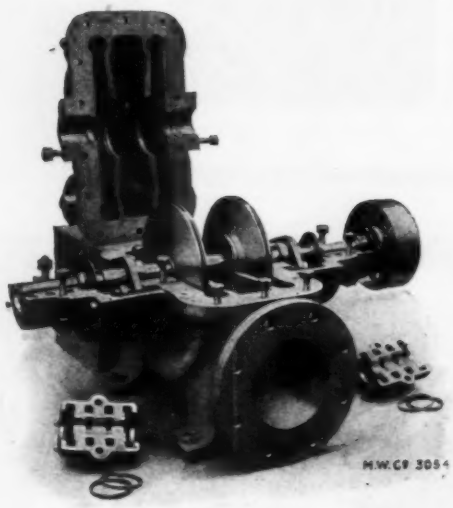

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We have also in progress for early delivery:

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ONE 15 cwt. **"Rigby" Hammer,** arranged for hand working only.

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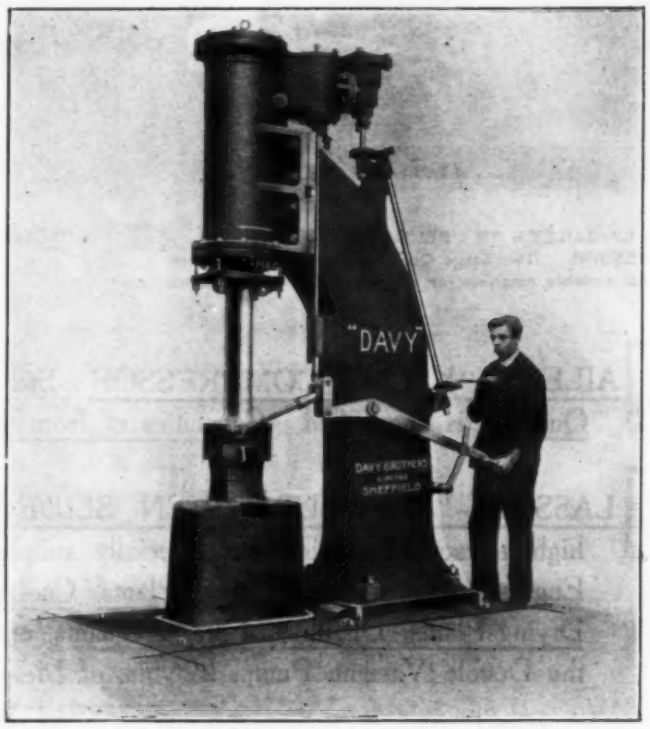

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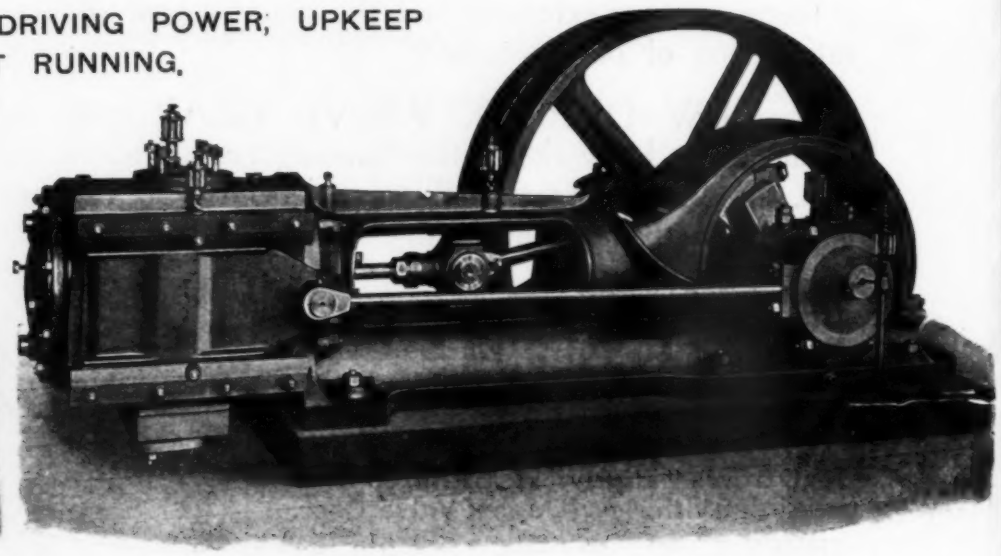
Bailey's

AIR COMPRESSORS AND "DRY" VACUUM PUMPS.

REMARKABLE FOR LOW DRIVING POWER, UPKEEP AND SILENT RUNNING.

CLASS L.—BAILEY'S "K" BELT-DRIVEN COMPRESSOR. Two-Stage Compression in one Cylinder. The most suitable machine for the Workshop or the Mine.



CLASS C.—"K" BELT-DRIVEN SLIDE VALVE "DRY" VACUUM PUMP.

BAILEY'S "K" AIR COMPRESSOR; Steam, Belt, or Electric Driven. Its Reputation for Running Qualities is unequalled. Capacities of from 40-2000 cubic feet per minute.

CLASS C.—"K" BELT-DRIVEN SLIDE VALVE "DRY" VACUUM PUMPS give the highest vacuum obtainable. Specially suitable to work as Air Pumps for Condensers of Steam Engines, Central Condensing Plants, Cooling Towers, Condensers for Evaporating Plants, Vacuum Drying Plants, Distilling, Filtering Plants, etc. The single types maintain a vacuum of over 29·8in., the Double Vacuum Pumps 29·95in. of Mercury.

FIG. 15 D.—"DAVIDSON" PATENT INDEPENDENT AIR PUMP and JET CONDENSER.

BAILEY'S "WET" VACUUM PUMPS for Vacuum Pans, Condensers, etc.

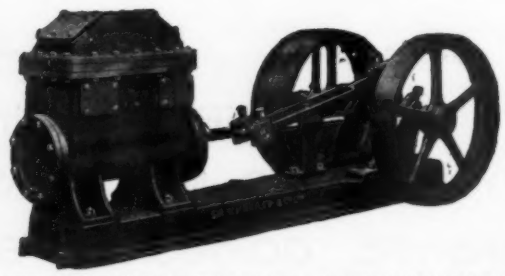


FIG. 5199.—BAILEY'S BELT-DRIVEN "WET" VACUUM PUMP.
FIG. 5210.—STEAM-DRIVEN.

WE ARE MAKERS OF THE EDWARDS AIR PUMPS IN ALL SIZES.

Manufactured by

Sir W. H. Bailey & Co LTD

ALBION WORKS, SALFORD, MANCHESTER.

IF·YOU·WANT A·GOOD·PUMP– YOU·WANT·A WEIR·PUMP

FOR BOILER-FEEDING
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FOR GENERAL DUTIES
of all Kinds

FOR OIL TRANSFER AND BURNER DUTY
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STANDARD TYPES
Steam or Electrically Driven

EFFICIENT SERVICE & DELIVERY.

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Full particulars of Weir Pumps on request.

G. & J. WEIR LTD.
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B.T.H. Traction Equipment

Power Station Equipment

Sub-Station Equipment

Automatic Sub-Station Equipment

Electric Locomotives

Train Motors

Automatic and Non-Automatic, Electro-Magnetic and Electro-Pneumatic Control Gear

Self-Regulating Motor Generators

Air Compressors

Air Exhausters

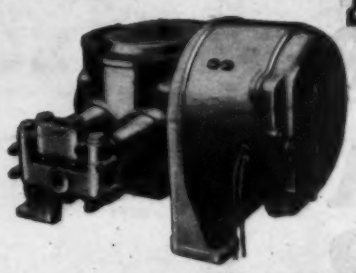
Tramway Motors and Controllers

Trolley-Bus Motors and Controllers

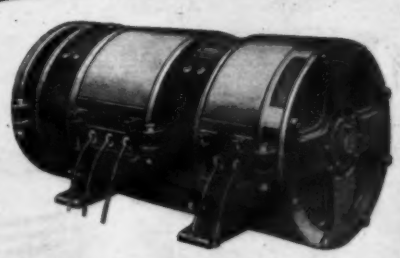
Etc.

B T-H

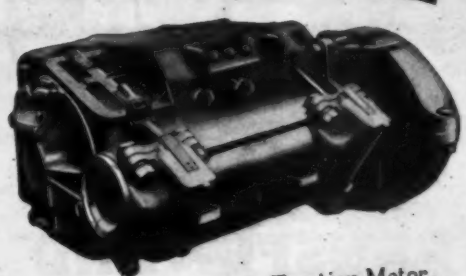
Traction Equipment



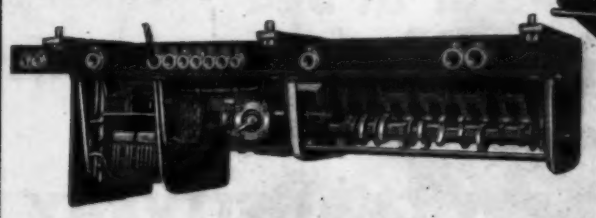
B.T.H. Motor-driven Air Compressor.



B.T.H. Self Regulating Motor-Generator.



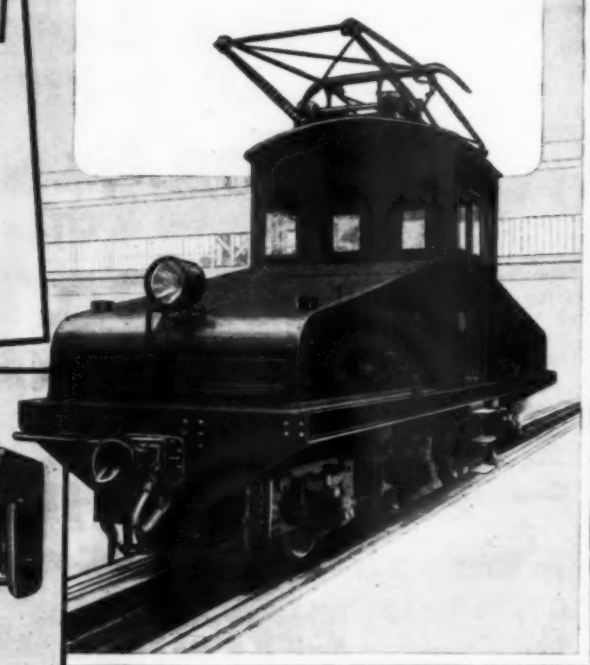
B.T.H. Ventilated Interpole Traction Motor.



B.T.H. Electro-pneumatic Motor Controller.

B.T.H. Traction Equipments, suitable for operation on any system, can be supplied for all classes of service, with automatic or non-automatic electro-magnetic or electro-pneumatic control, as may be desired.

All auxiliary plant, such as compressors and exhausters for air and vacuum brakes, self-regulating motor generators for auxiliary low-tension supply, switchgear, etc., is manufactured by this Company, and thus complete equipment can be supplied for main line locomotives, multiple unit trains, or any other service.



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Electrical Engineers and Manufacturers

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B T-H

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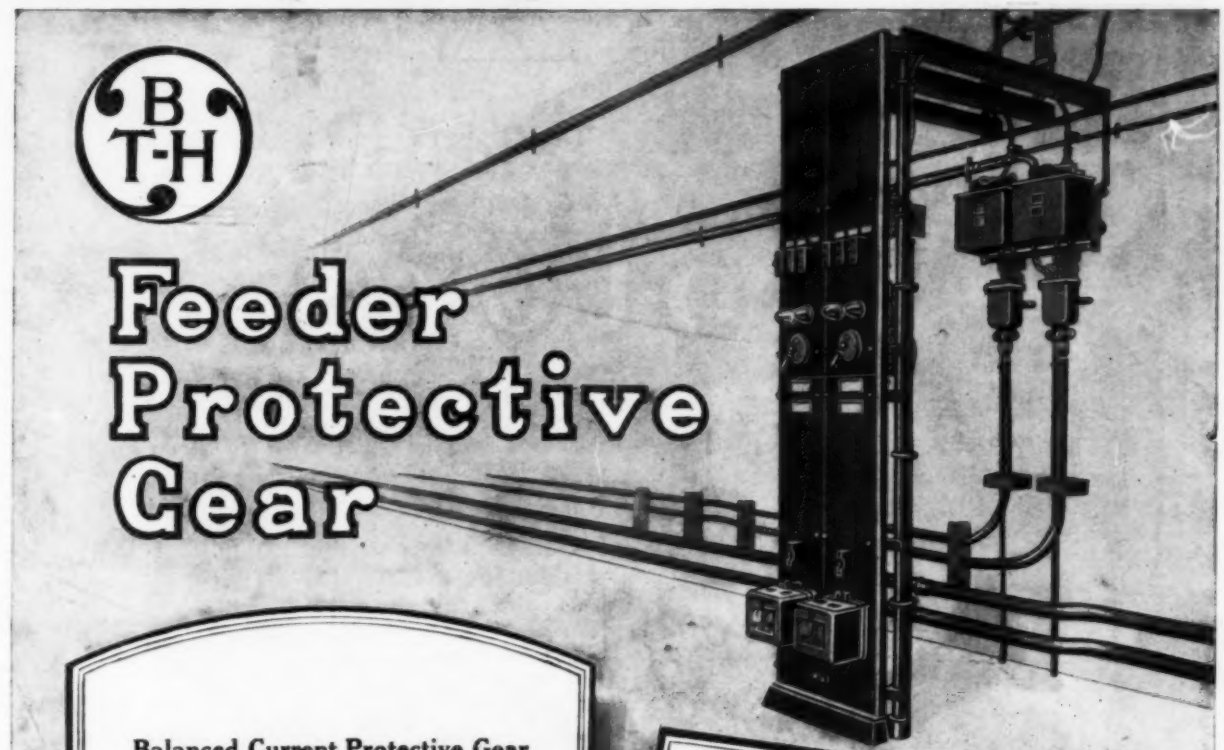
B T-H

Feeder Protective Gear



Balanced Current Protective Gear

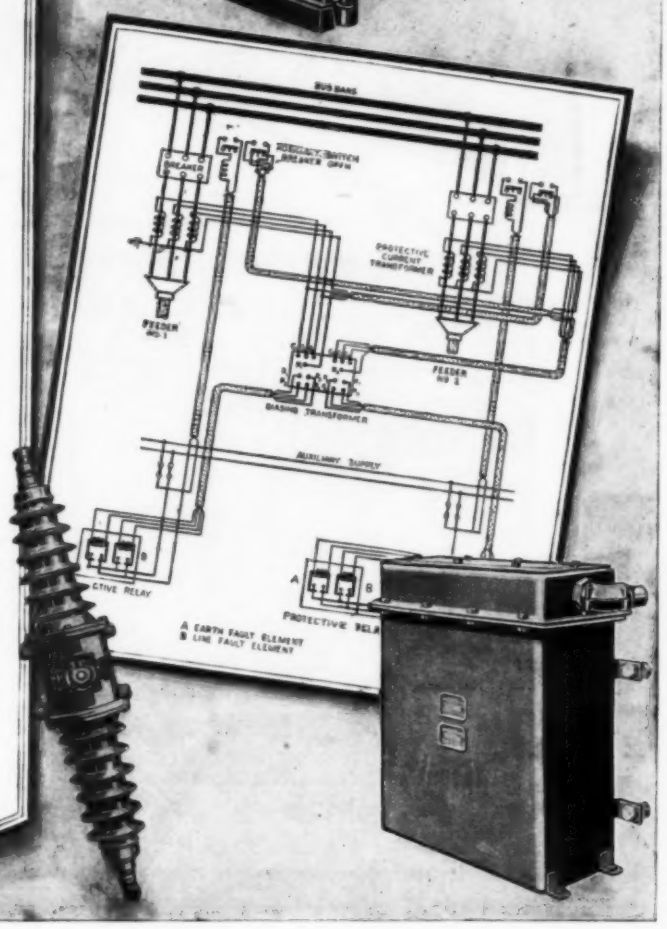
B.T.H. Balanced Current Feeder Protective Gear provides discriminating protection for parallel feeders without using pilot cables.

The operation of this system depends upon the balance of the currents in parallel feeders, and when this balance is upset by either an earth fault or a phase fault, the defective feeder is isolated through the medium of a relay actuated by Protective Transformers and a Biasing Transformer which also restrains the relays on the healthy feeders.

Balanced Power Protective Gear

B.T.H. Balanced Power Feeder Protective Gear is similar in general principle to the Balanced Current Protective Gear described above, with the addition that it includes the important feature of directional operation.

These and other forms of Protective Gear are fully described in D.L. 4471, which will be sent on application.



B.T.H. Switchgear

Power Station Switchgear

Sub-Station Switchgear

Automatic Sub-Station Switchgear

110,000-Volt Oil-immersed Circuit Breakers

H.T. Switchgear

L.T. Switchgear

Truck Type Switchgear

Compound-filled Switchgear

Switchboards

Protective Gear

"Tirrill" Automatic Voltage Regulators

Etc.

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EAST AFRICA	Mombasa, Kenya Colony Zanzibar, Kenya Colony	SPAIN	Madrid
EGYPT	Cairo	TASMANIA	Hobart, Launceston
JAPAN	Osaka	URUGUAY	Monte Video

B.T.H. Motors

—

Auto-Synchronous Motors

Slip-Ring Induction Motors

Squirrel-Cage Induction Motors

Variable Speed A.C. Motors

Synchronous Motors

Industrial Motors A.C. & D.C.

Tramway Motors

Train Motors

Crane Motors

Rolling Mill Motors

Winding Motors

Loom Motors

Fractional Horse-power Motors

Etc.

The illustrations show B.T.H. Motors and Control Gear driving a large battery of screw-making automatics.

Due to their low temperature rise and heavy overload capacity B.T.H. Motors give reliable service under the most arduous conditions. They are manufactured in all sizes over a wide speed range and can be supplied for either alternating or direct current systems.

The design of these motors is based on extensive experience of industrial drives of every description, and thus they are of extremely robust construction and give continuous service with minimum attention.

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GLASGOW	51, Pitt Street	SWANSEA	Mazda House, 7, Melbourne Place
LIVERPOOL	14/16, South Castle Street		

Control Gear

The illustration shows several units of B.T.H. automatic reversing contactor control gear for use in Steel Works and Shipyards.

for

Steel Mills.

B.T.H. automatic reversing contactor control gear operates on a current limit system which ensures that the contactors close in their correct sequence, and—what is of great importance—accelerate the motor in the shortest safe time consistent with the load conditions.

All contactors, relays, isolating switches, resistances, etc., are mounted as a complete unit in a sheet steel case, which can be fitted with either cable or conduit connections.

These units are operated by a small master controller, which may be mounted in any convenient position, so that the motor is under complete control during any operation.

To assist in giving full information on the most suitable type of control gear, kindly indicate the duty to be fulfilled.

B.T.H. Control Gear.

Starting Rheostats

Starting Panels

Auto-Transformer Starters

Crane Controllers

Tramcar and Trolley Bus Controllers

Y-Delta Starters

Push-Button Stations

A.C. & D.C. Contactor Starting Gear

Drum Controllers

Mining Controllers

Field Regulators

D.C. Protective Panels

Discharge Resistances

Etc.

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B T-H

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SPAIN	Madrid
TASMANIA	Hobart, Launceston
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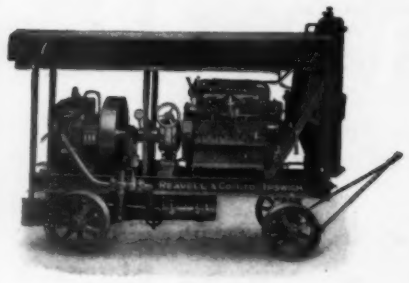
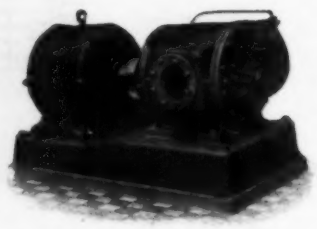
AIR COMPRESSORS.



Portable Oil Engine-driven Compressor Set.



Rolling Drum Type Rotary Compressor.

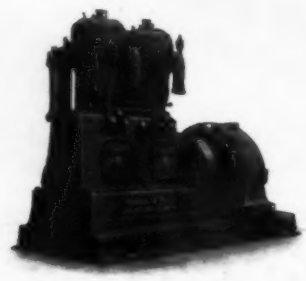
WE ARE SPECIALISTS IN THE MANUFACTURE OF AIR COMPRESSING MACHINERY FOR ALL PURPOSES.

Single Stage Quadruplex Compressor.

STATIONARY AND PORTABLE UNITS OF ALL CAPACITIES SUITABLE FOR ANY PRESSURE.

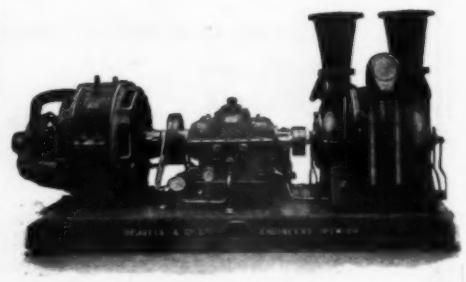
EFFICIENT, RELIABLE, COMPACT & ECONOMICAL.

WE ARE CONTRACTORS TO THE BRITISH ADMIRALTY, WAR OFFICE & AIR MINISTRY, THE INDIA OFFICE AND THE CROWN AGENTS FOR THE COLONIES.



Motor-driven High Pressure Compressor.

Write to Dept. "A" for Leaflets and Full Particulars.



Motor-driven Turbo Exhauster.

REAVELL & CO., LTD.,
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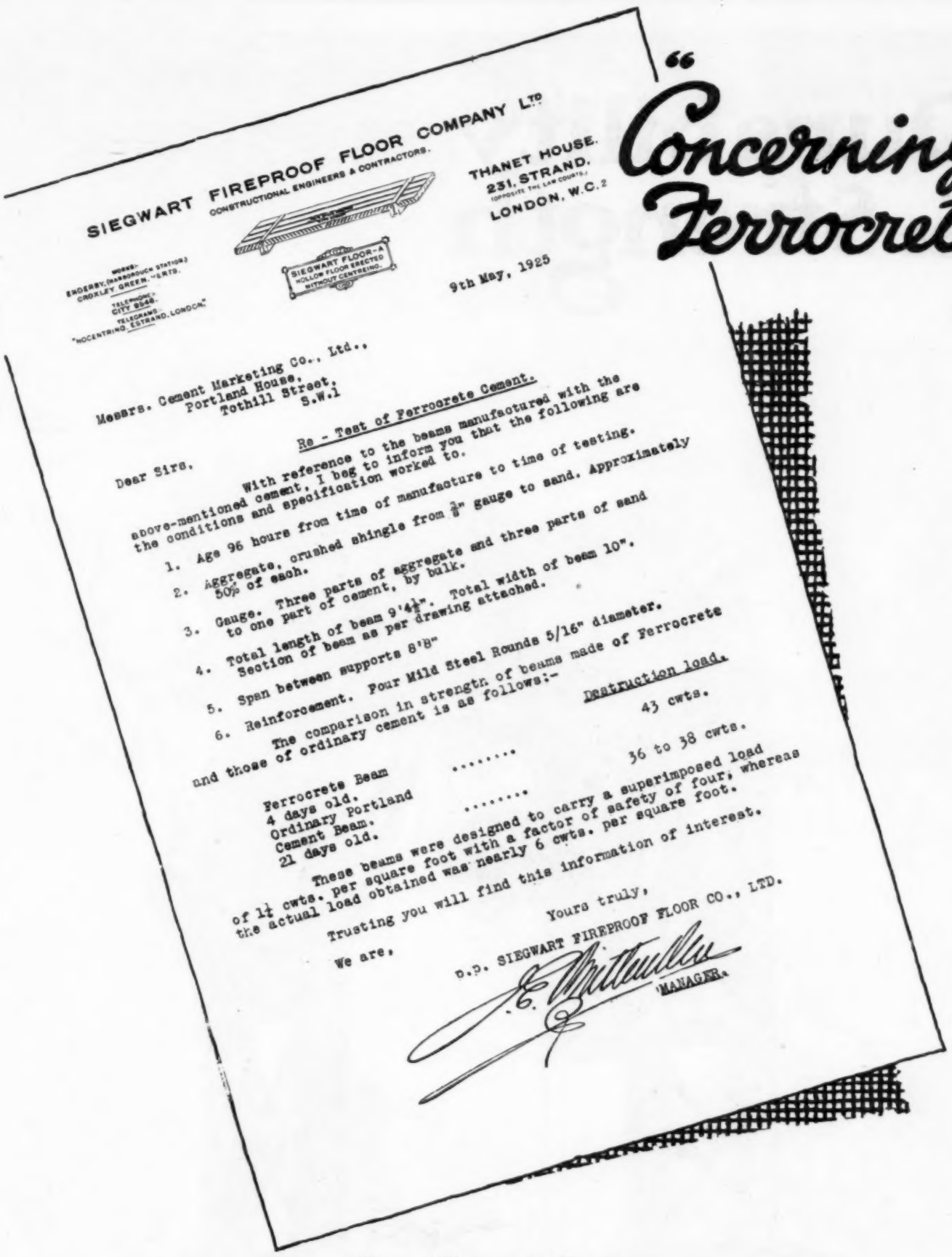

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Dear Sirs,

Re - Test of Ferrocrete Cement.

With reference to the beams manufactured with the above-mentioned cement, I beg to inform you that the following are the conditions and specification worked to.

1. Age 96 hours from time of manufacture to time of testing.
2. Aggregate, crushed shingle from ⅜" gauge to sand. Approximately 50% of each.
3. Gauge. Three parts of aggregate and three parts of sand to one part of cement, by bulk.
4. Total length of beam 9'4½". Total width of beam 10".
5. Span between supports 8'8"
6. Reinforcement. Four Mild Steel Rounds 5/16" diameter. Section of beam as per drawing attached.

The comparison in strength of beams made of Ferrocrete and those of ordinary cement is as follows:-

	Destruction load.
Ferrocrete Beam 4 days old.	43 cwts.
Ordinary Portland Cement Beam. 21 days old.	36 to 38 cwts.

These beams were designed to carry a superimposed load of 1¼ cwts. per square foot with a factor of safety of four, whereas the actual load obtained was nearly 6 cwts. per square foot.

Trusting you will find this information of interest.

We are,

Yours truly,
p.p. SIEGWART FIREPROOF FLOOR CO., LTD.
MANAGER.

"Concerning Ferrocrete"

You will eventually use

"FERROCRETE"

The rapid-hardening Portland Cement.

Why not start now?

Write for a copy of "Rapid-Hardening Ferrocrete, its Characteristics and Uses," which gives full details, and also a copy of "Report on Tests on "Ferrocrete" by Dr. Oscar Faber, O.B.E., D.Sc., M. Inst. C.E.

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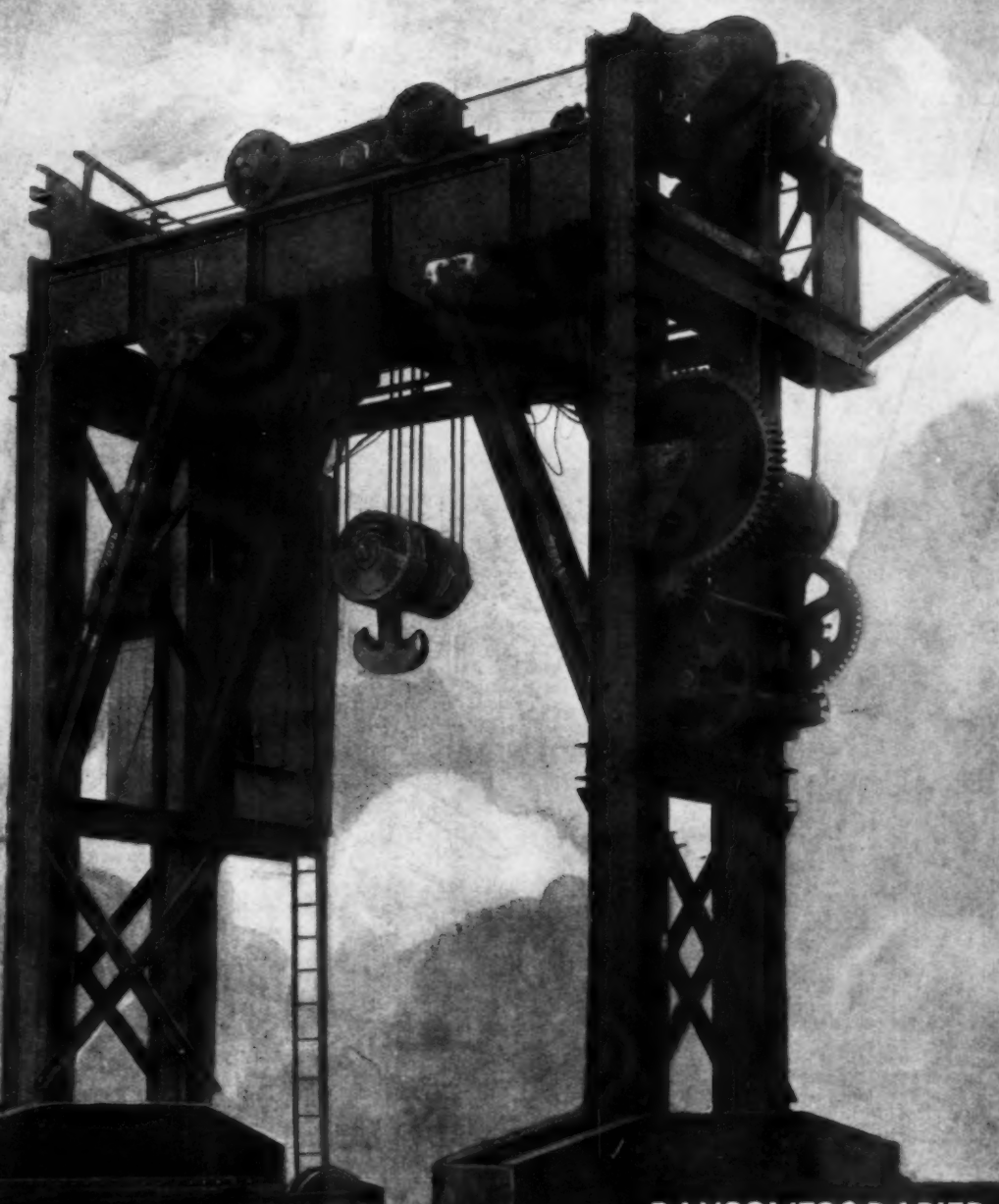
Durability & Strength



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4-5 METRES SPAN
3 MOTOR TYPE
DIRECT CURRENT 220 VOLTS
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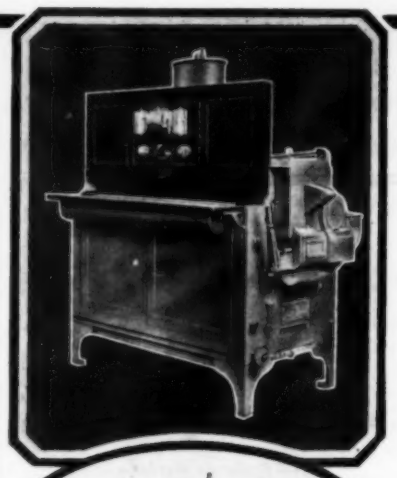

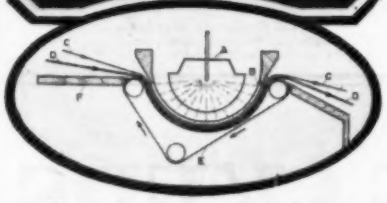

A—Horizontal Arc Lamp
B—Glass Bend
C—Tracing
D—Photo Paper
E—Endless Band
F—Feed Board

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THE "Hall-Mark" is a continuous feed machine having *one* 10 ampere *horizontal* arc lamp of an entirely new and special design for photo-printing. The machine has a normal printing capacity equal to 250 double elephant blue-prints or 60 double elephant ferro-gallic prints per hour. It has a lower current consumption per print than any other continuous feed machine.

The operation of the machine is entirely automatic, and a boy or girl can obtain perfect results. Judged from the point of view of an investment the "Hall-Mark" Photo-Printer will rapidly return its initial cost by the economies which it effects. It is made in our own factories, and is the result of a cumulative experience in copier construction and actual photo-printing.

B·J·HALL & Co. LTD.

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"Hall-Mark"

CONTINUOUS CONTACT PHOTO-PRINTER

M.3.

F.4.

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FOR COLD PRESSING.

FIRTH STAYBRITE S+S TRADE MARK

FIRTH "STAYBRITE SILVER STEEL" with a yield point of 12 to 15 tons per sq. in. and an elongation of 55% to 70%, has exceptional ductility, combined with maximum corrosion-resisting qualities. It may be cold pressed to a degree far in advance of the so-called "Stainless Iron," and, moreover, it presents no difficulties in manipulation, since it can be welded, soldered, brazed and rivetted without trouble.

This steel, which has created a profound interest,
is being specified for such purposes as:—

OIL REFINERY PLANT—NITRIC ACID PLANT.
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and for many Domestic and Decorative purposes, such as:—

FORKS—SPOONS—NAME PLATES—PANELS—HEARTH FITTINGS—BED WARMERS—CIGARETTE CASES—FLASKS—LADLES—TENNIS POSTS—MILKCANS—CANDELABRA—MILITARY & OTHER BUTTONS, ETC.

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STEAM TRAPS AND THERMOSTATS FOR ALL PURPOSES.

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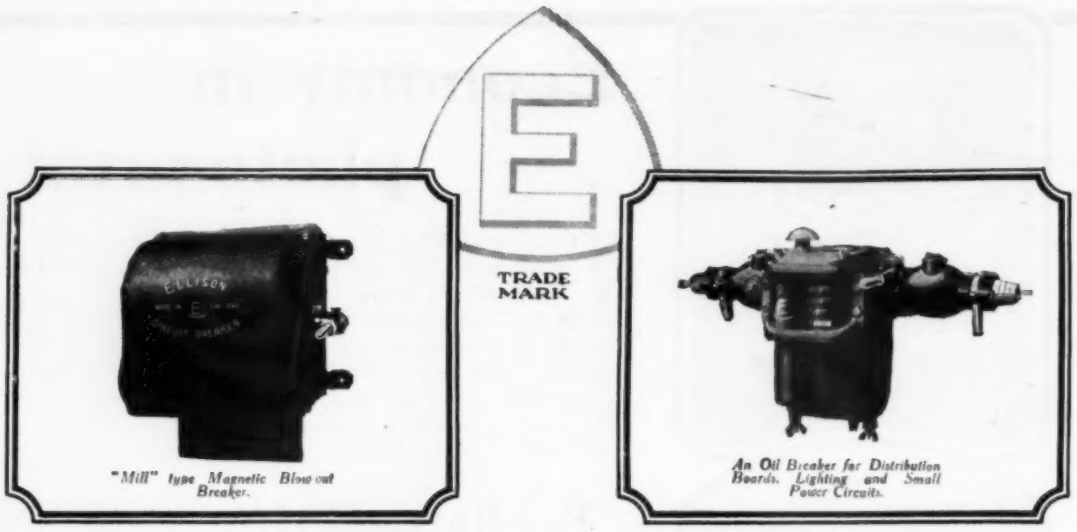
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"Mill" type Magnetic Blow out Breaker.
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are necessary to protect
ELECTRIC MOTORS

A Circuit Breaker is the only practical means of protecting motors and motor-driven machinery against overloads. This breaker must be well made and have properly proportioned automatic releases with time lag retarders to restrain their action on momentary load peaks.

Fuses do not protect motors against overloads. If fuses are used, they must be heavily wired or frequent stoppages occur. If fuses are heavily wired then larger motors than necessary for the load have to be employed to safeguard against burn-out, with consequent loss of money because of poor efficiency and power factor.

Write for the "Ellison Booklet" which gives more information on the necessity for Electric Circuit Breakers.

"ELLISON" BREAKERS are standardised as follows:
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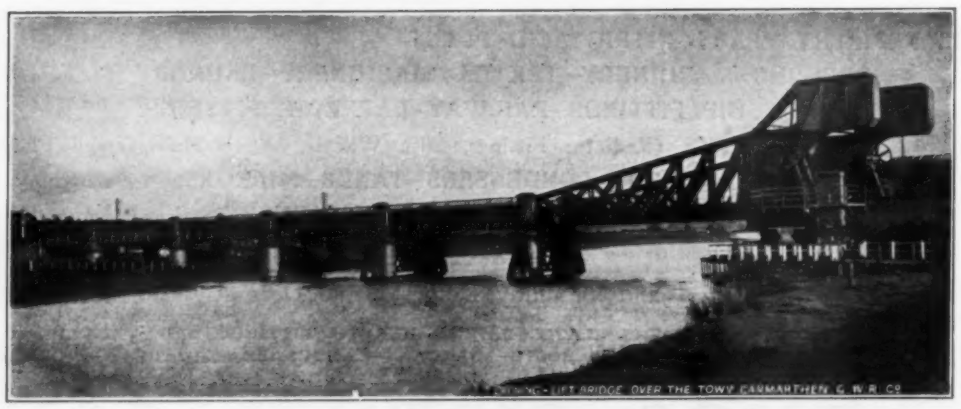

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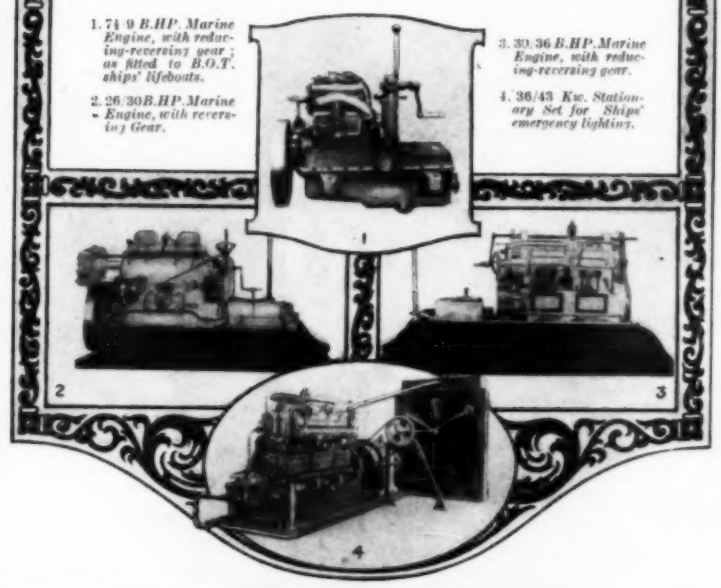

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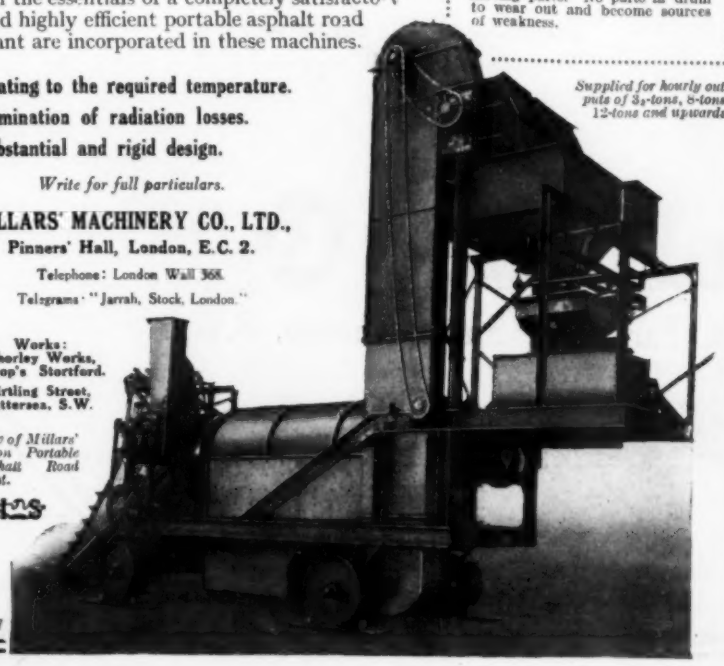

View of Millars' 8-ton Portable Asphalt Road Plant.

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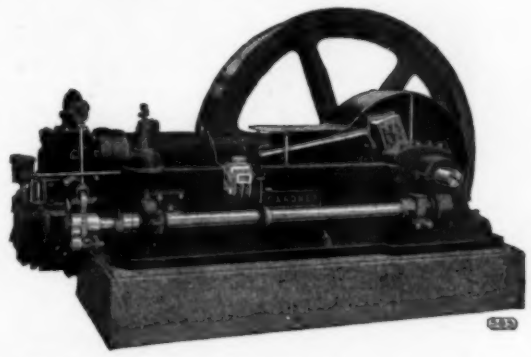

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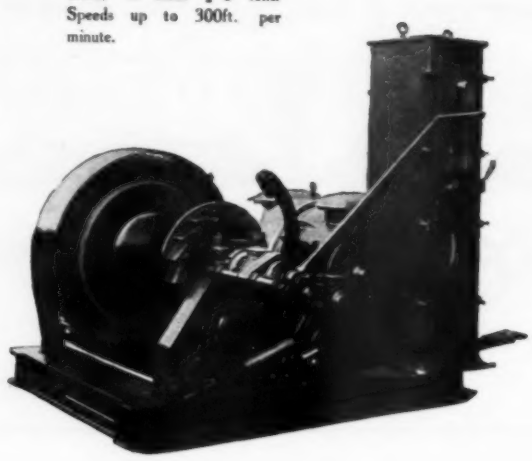

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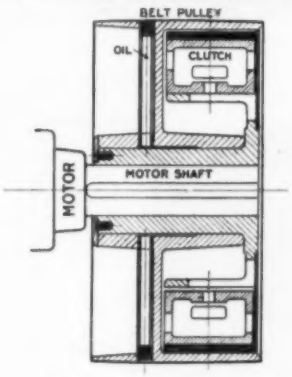

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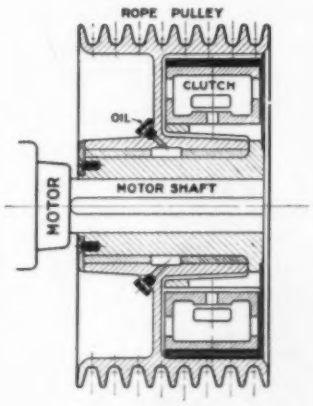

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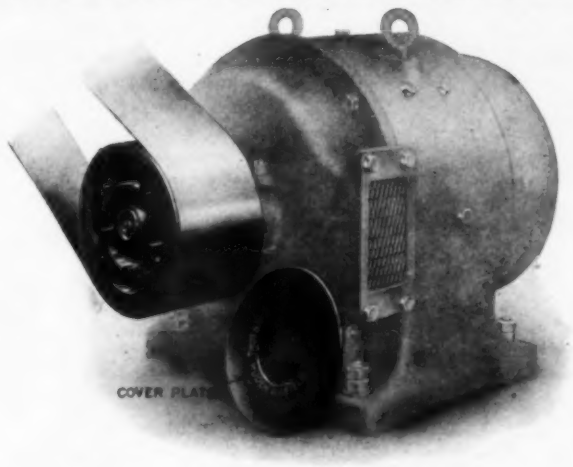

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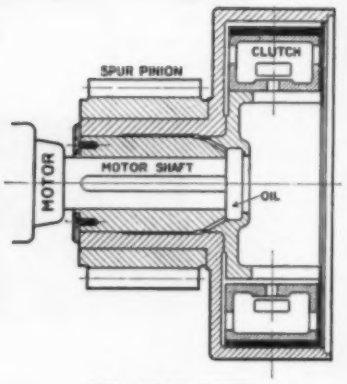

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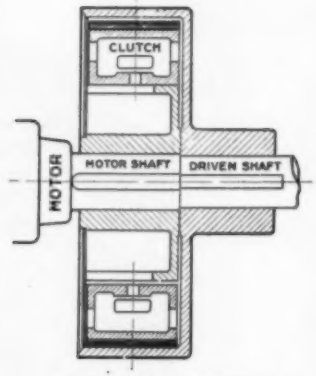

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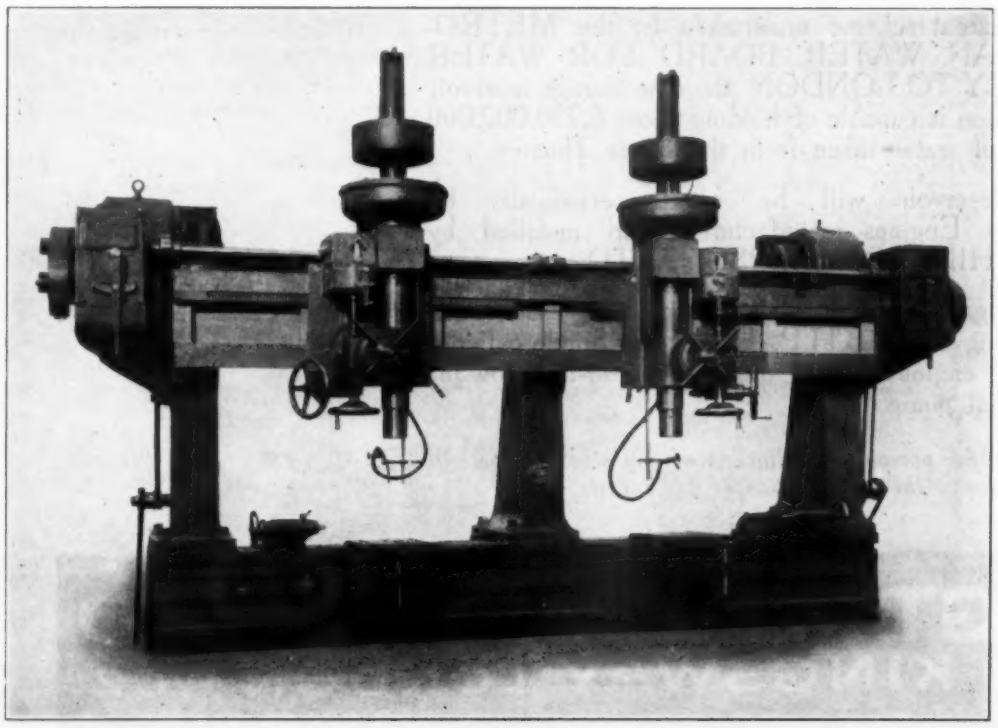

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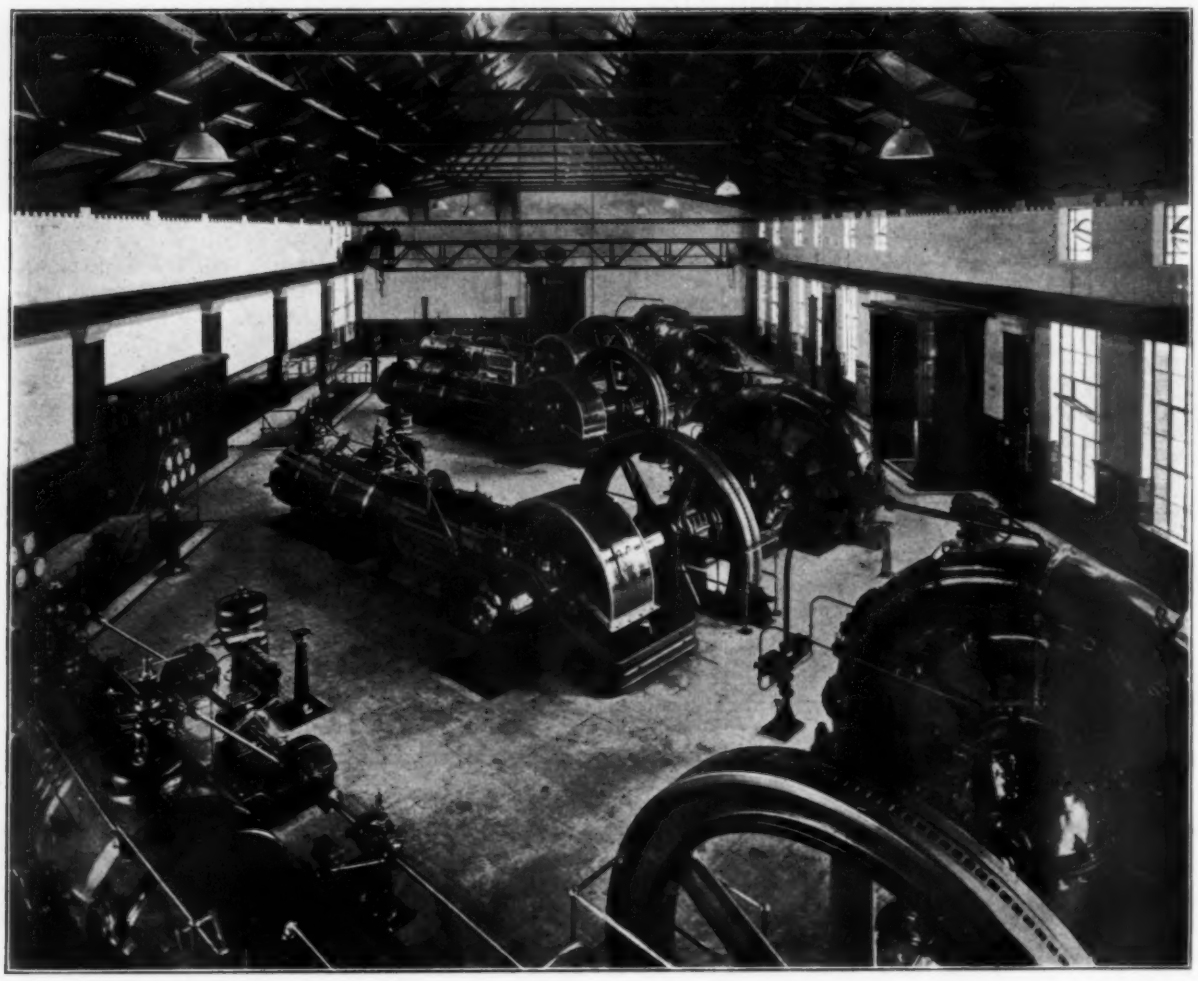

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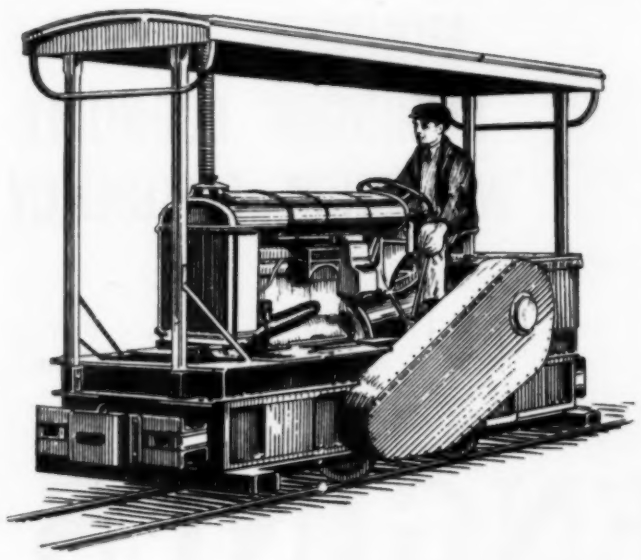

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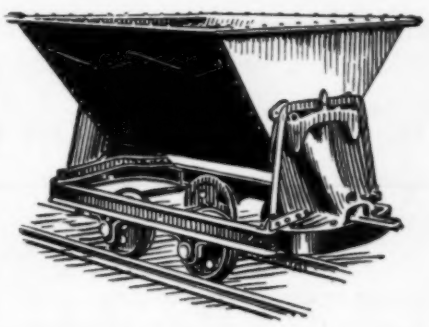

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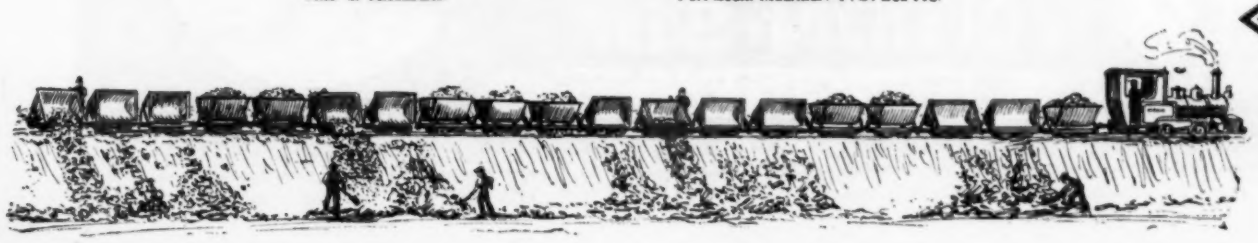

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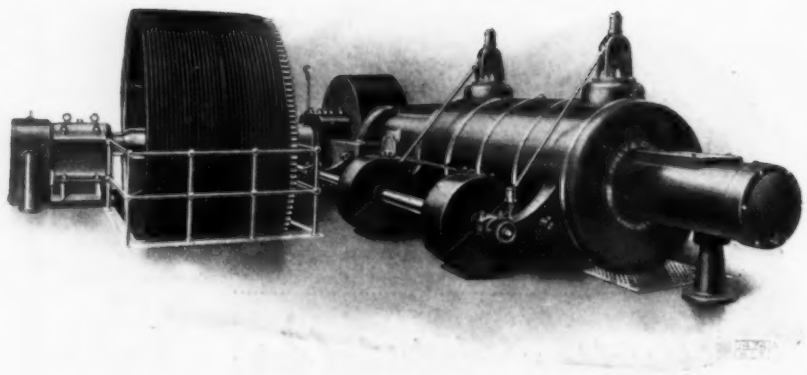

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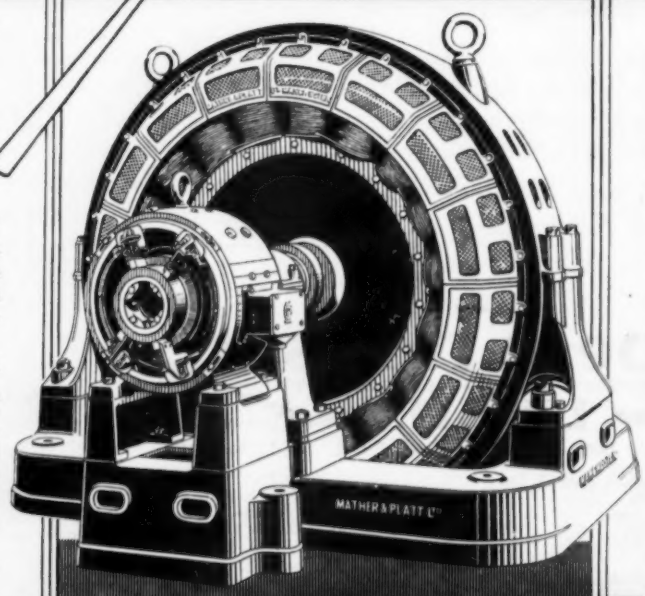

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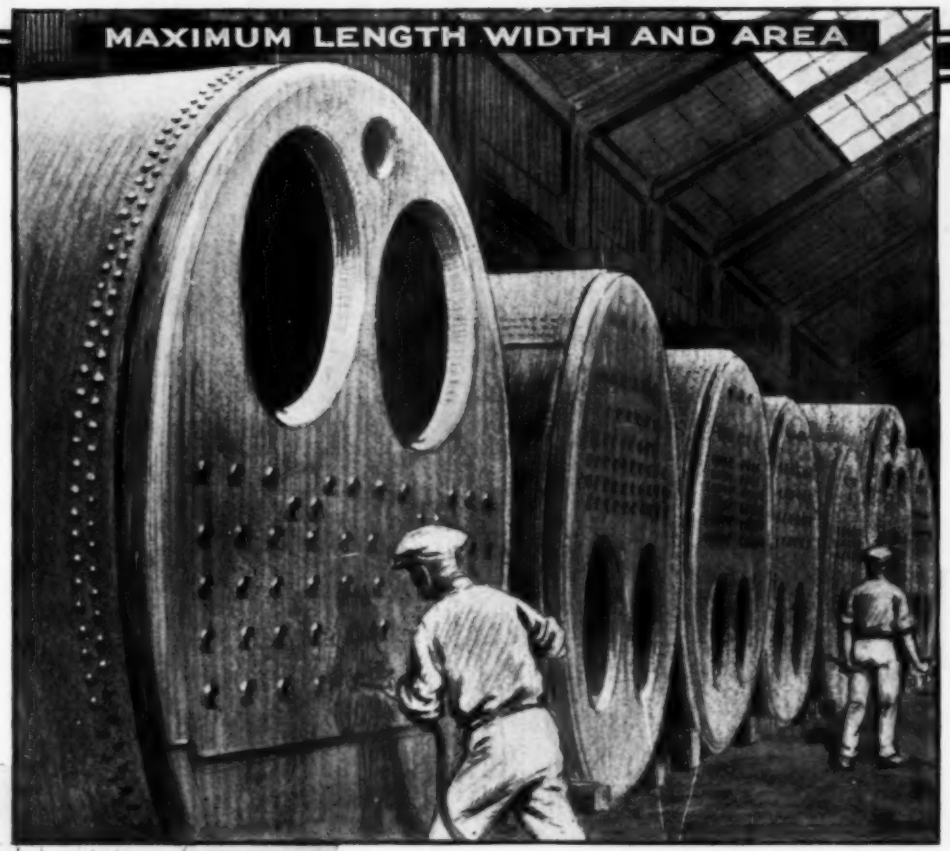

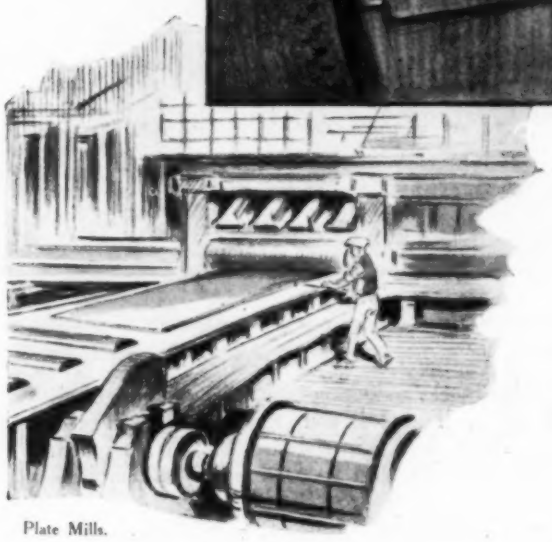

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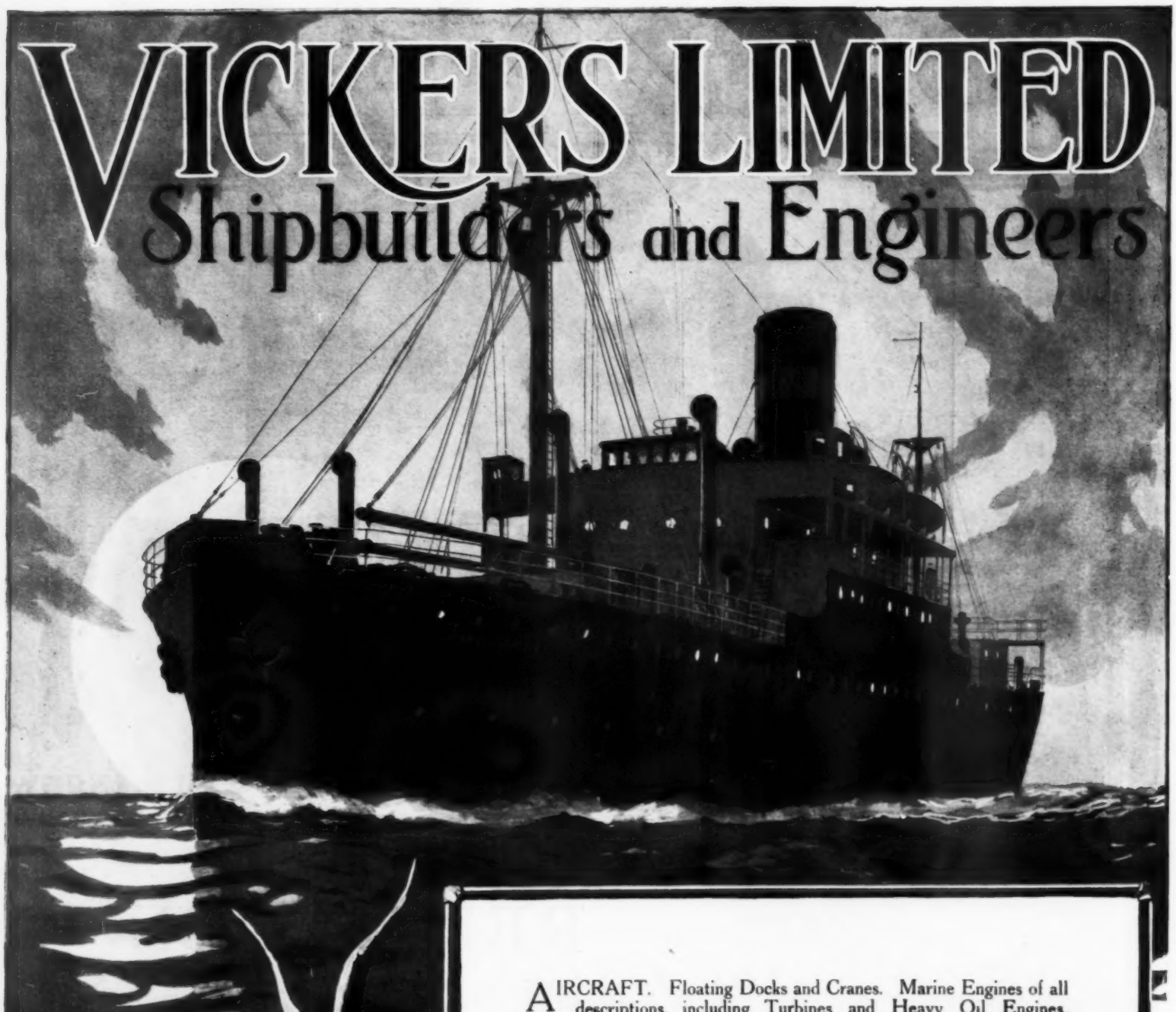

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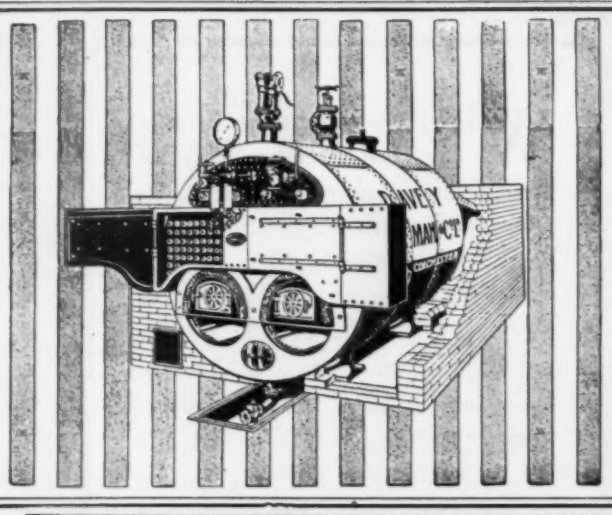

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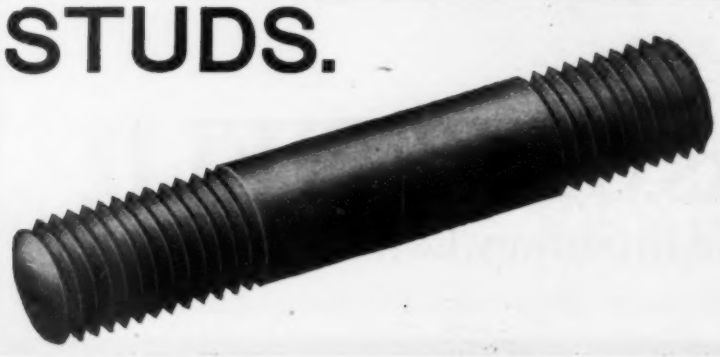

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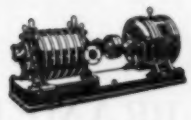

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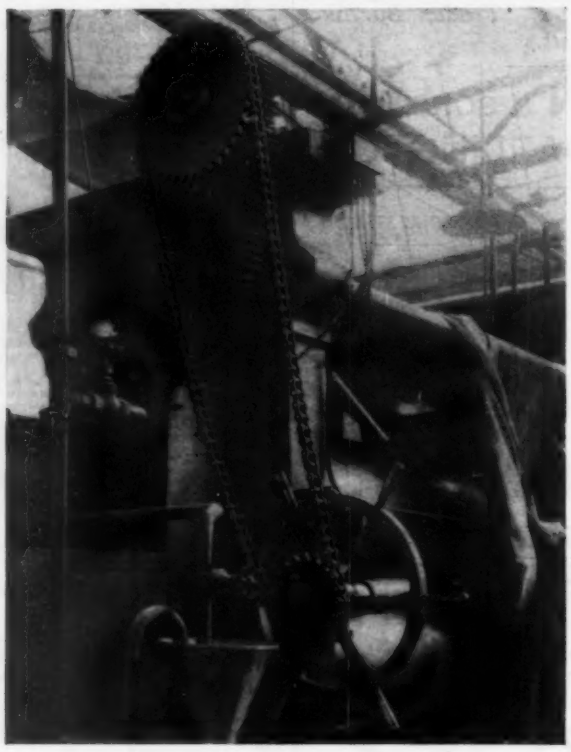

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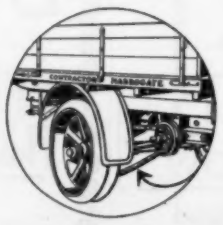

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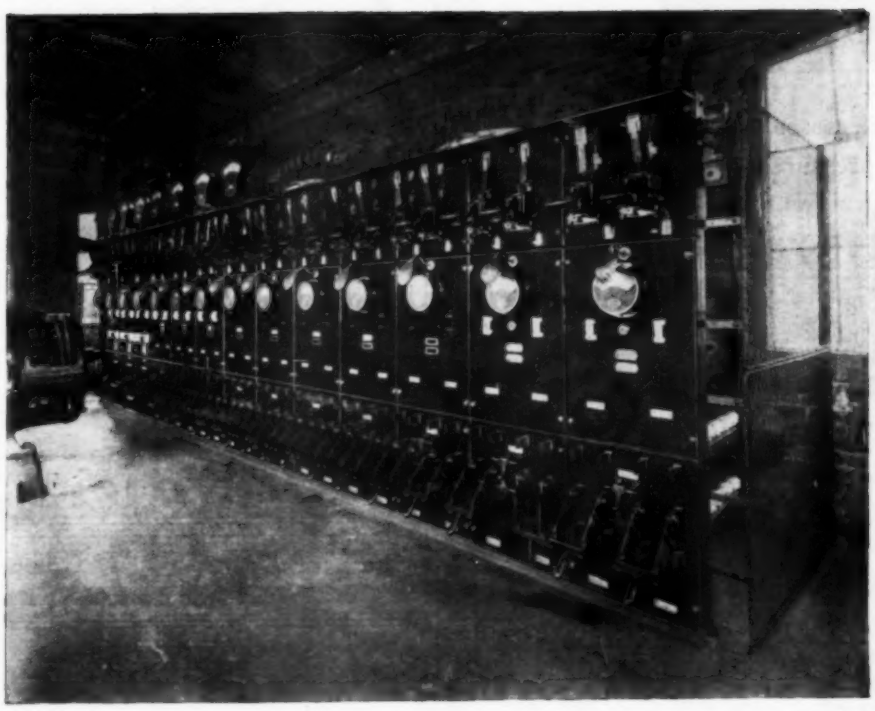

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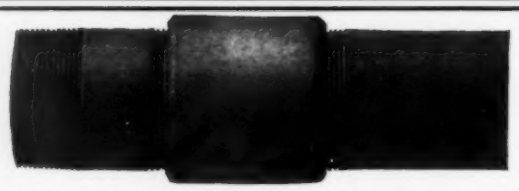

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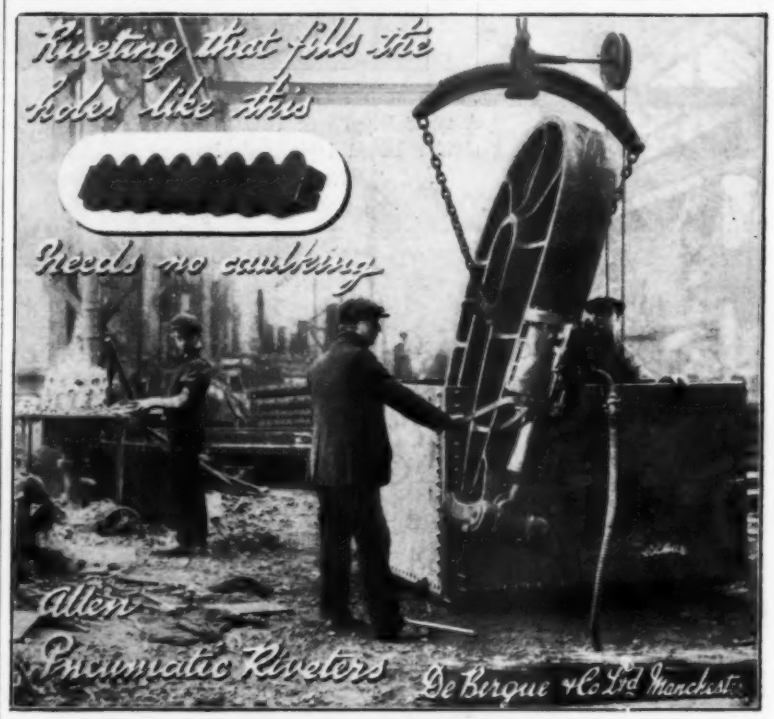

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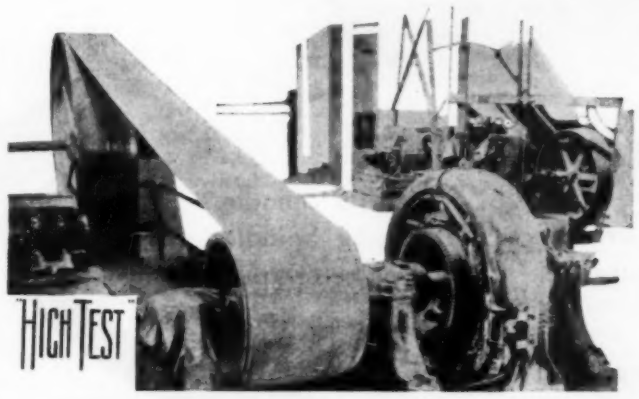

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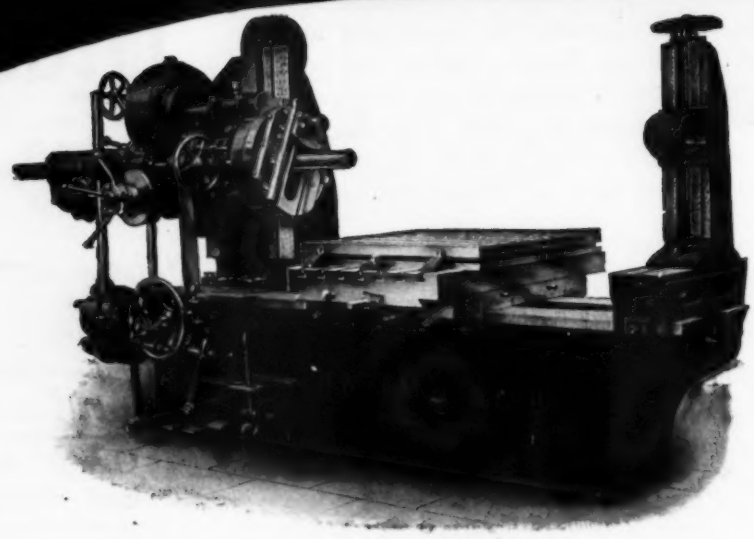

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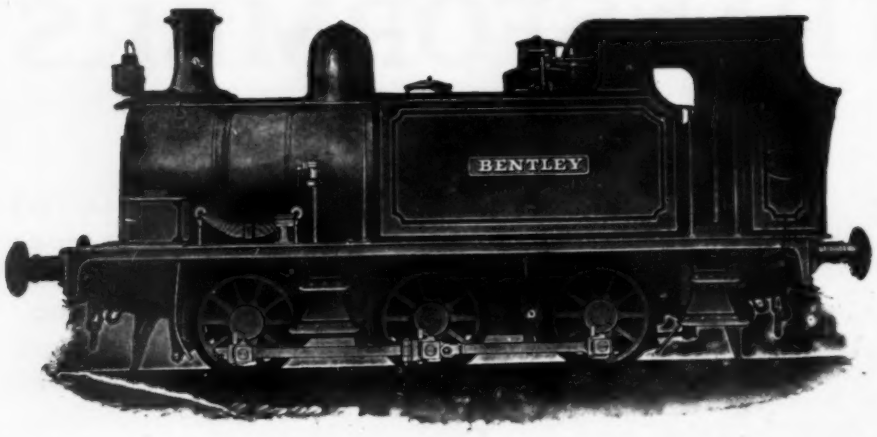

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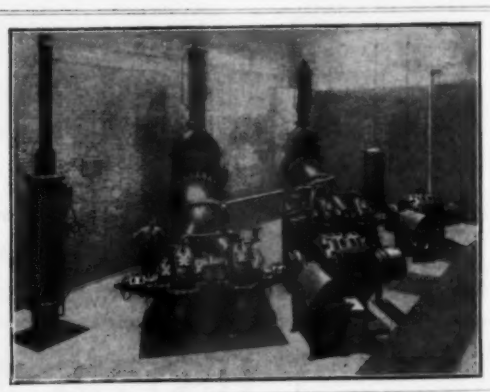

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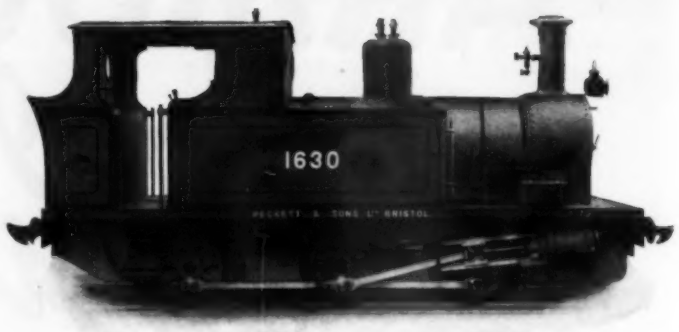

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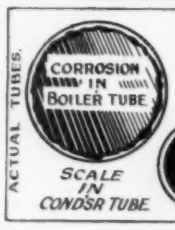

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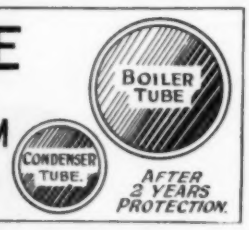

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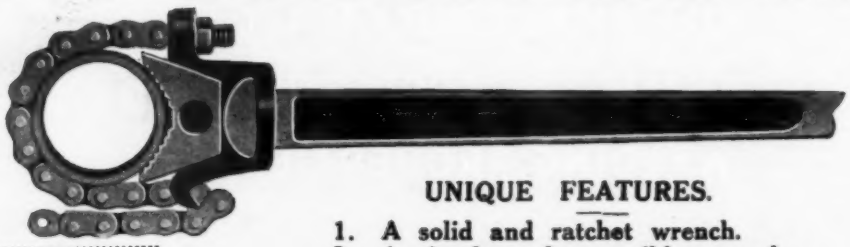

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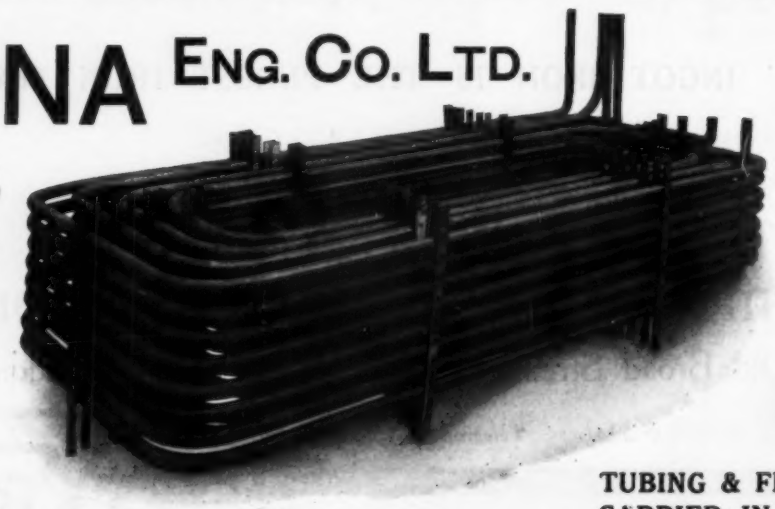

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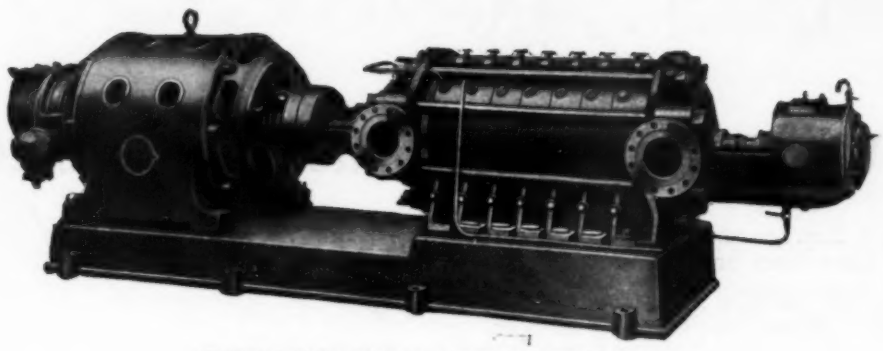

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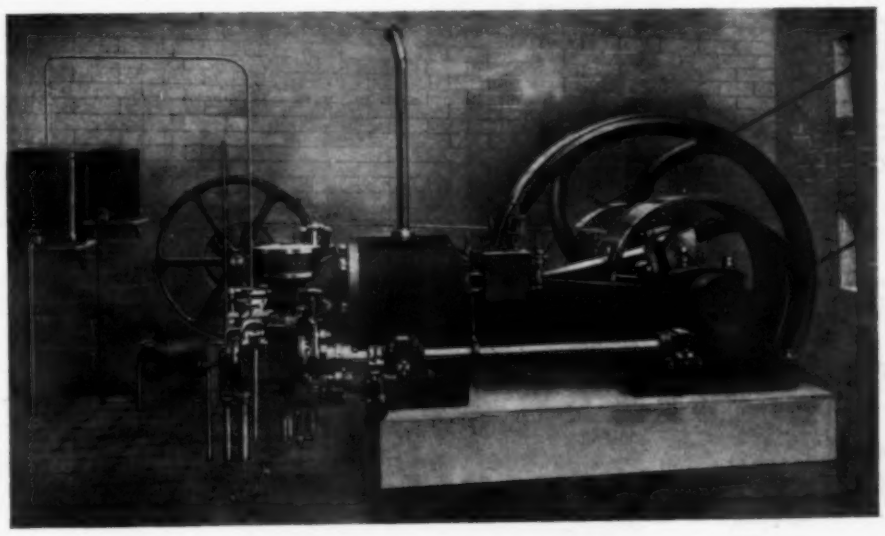

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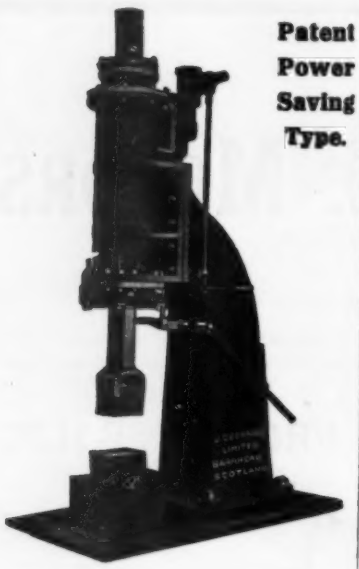

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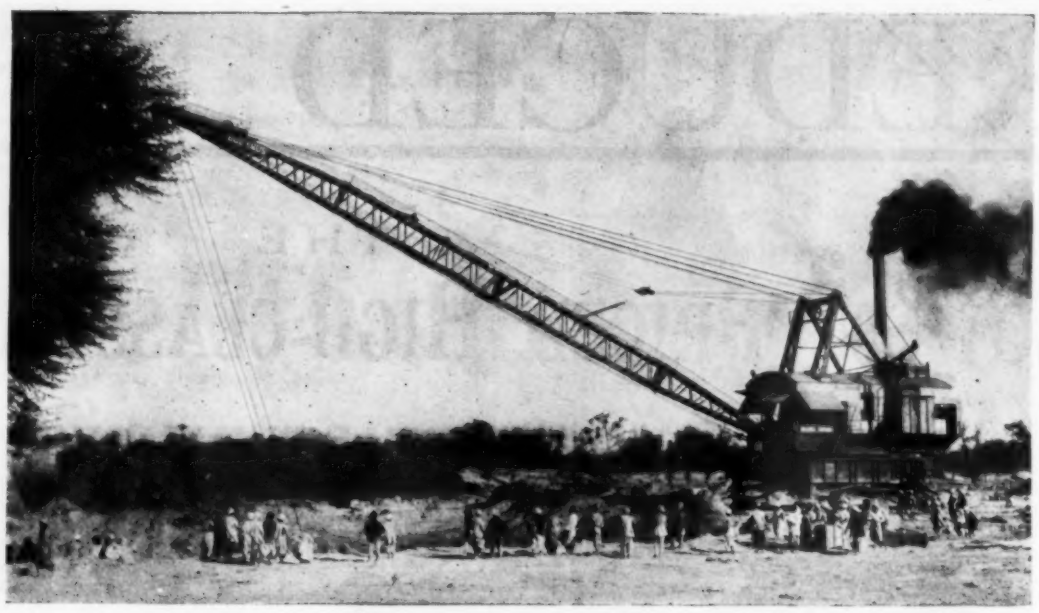

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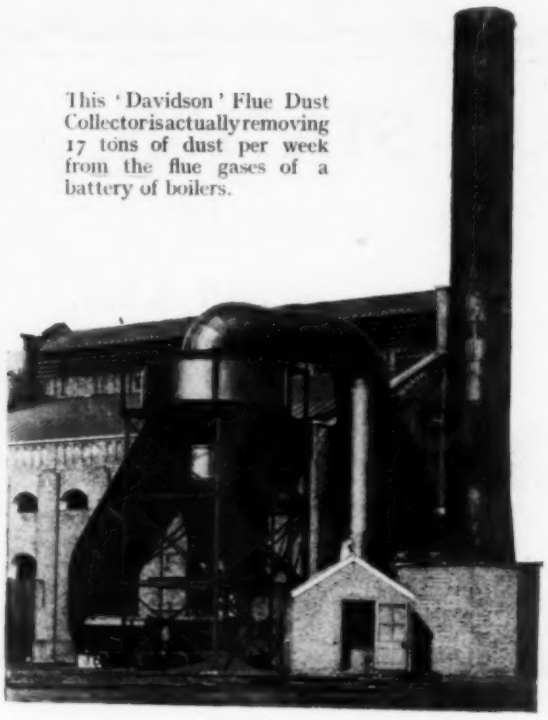

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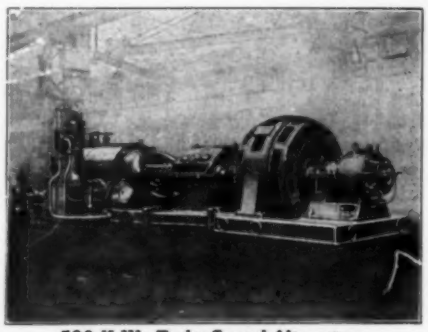

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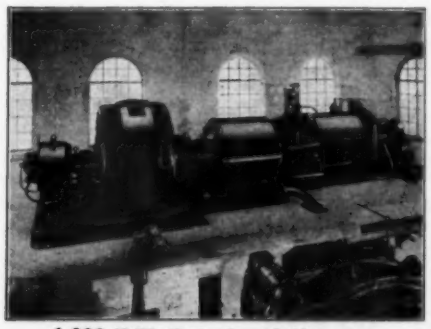

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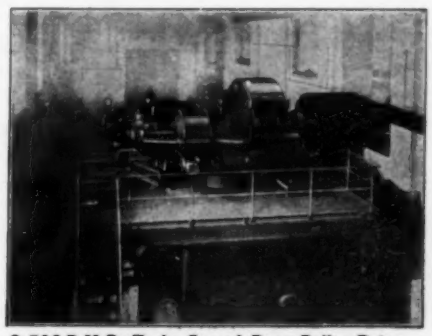

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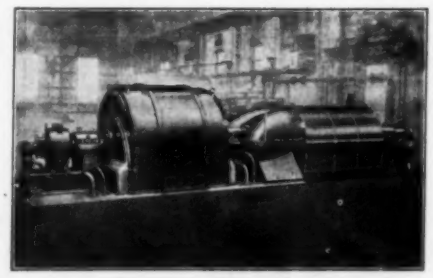
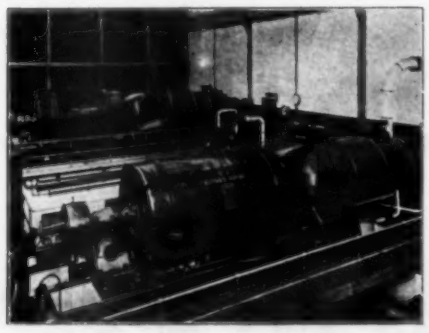
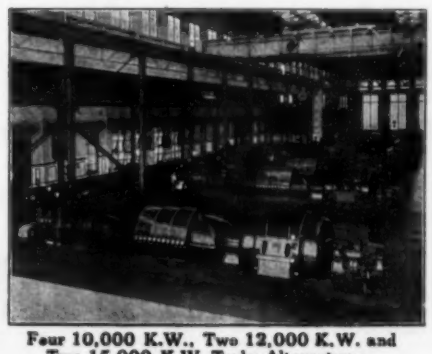


3,000 K.W. Turbo-Alternator, 3,000 R.P.M.



7,500 K.W. & 10,000 K.W. Turbo-Alternator, 3,000 R.P.M.



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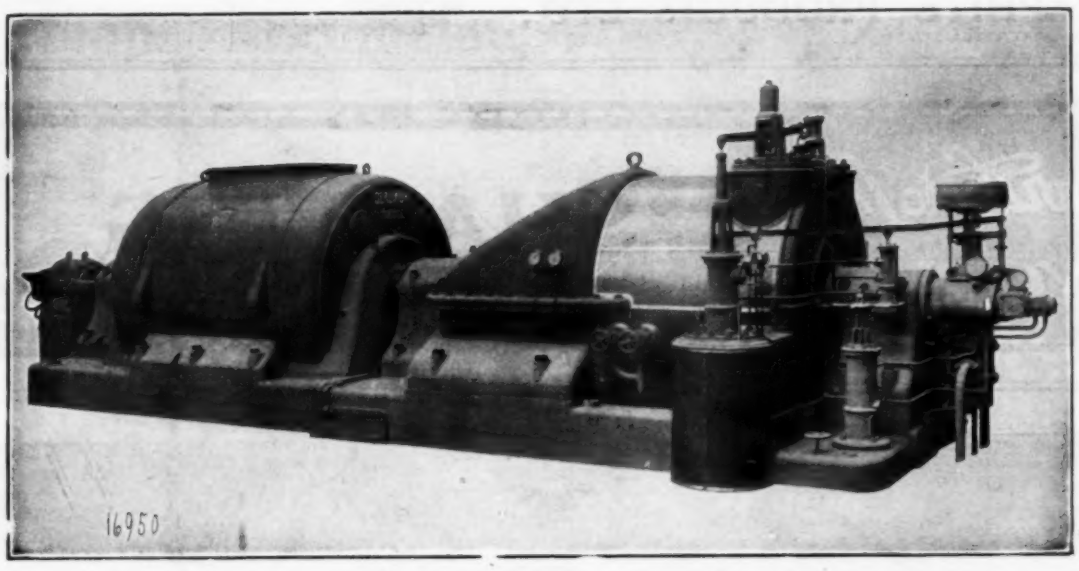

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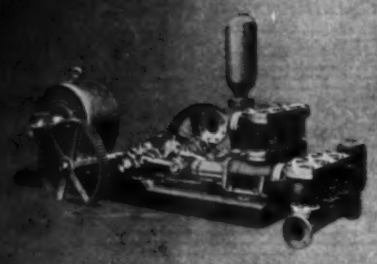

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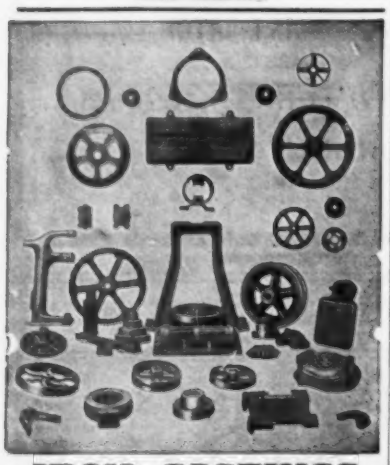

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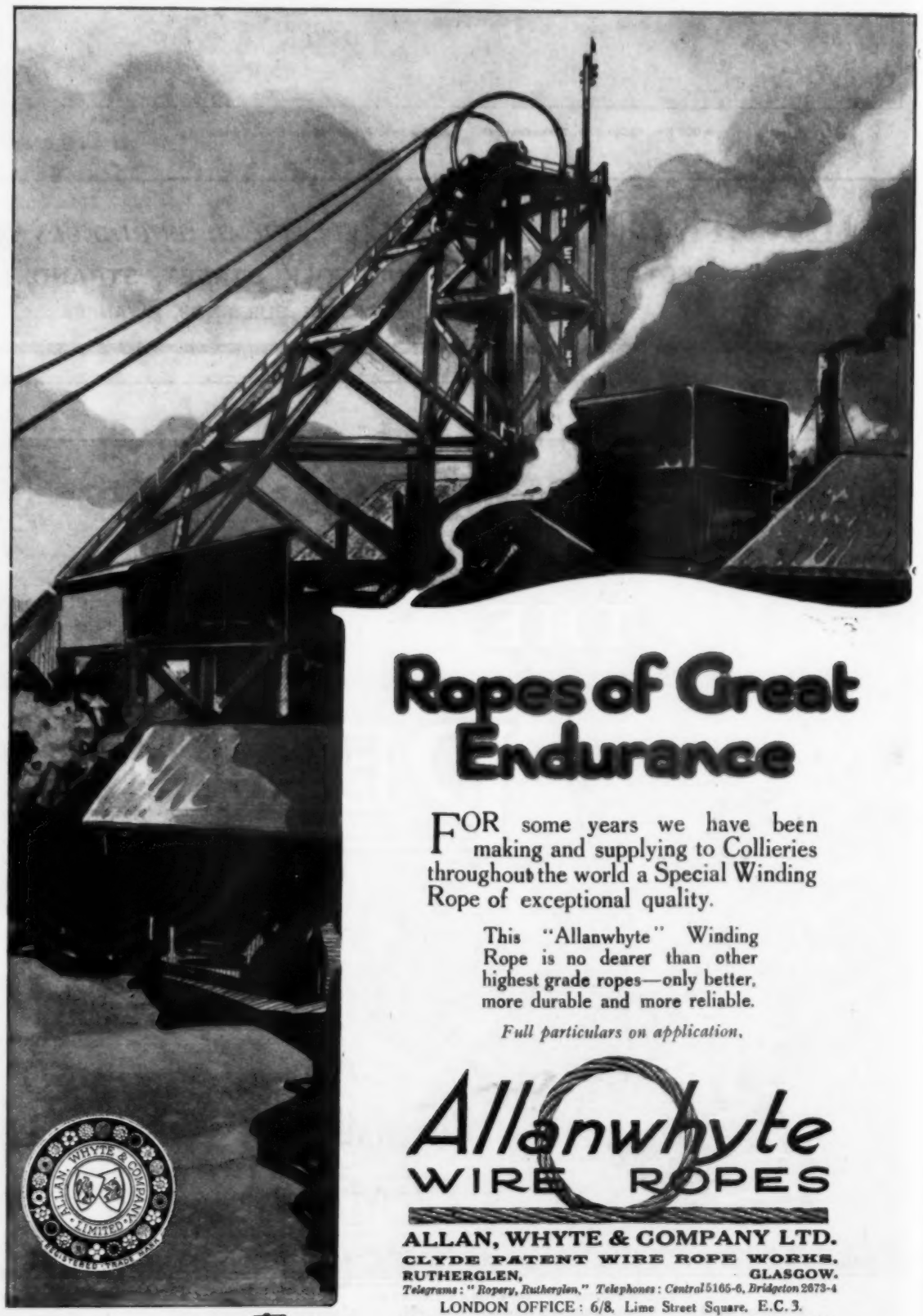

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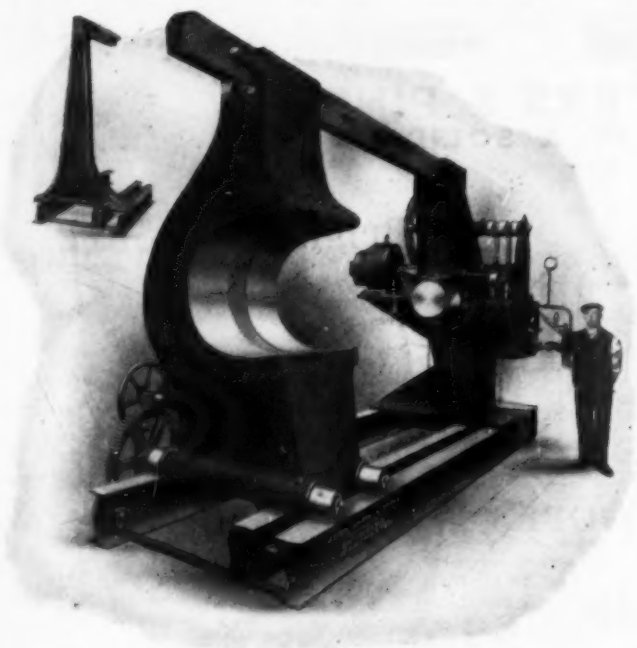

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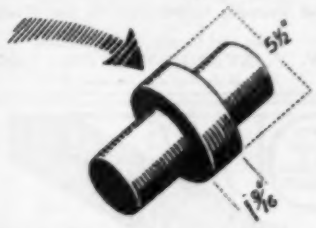

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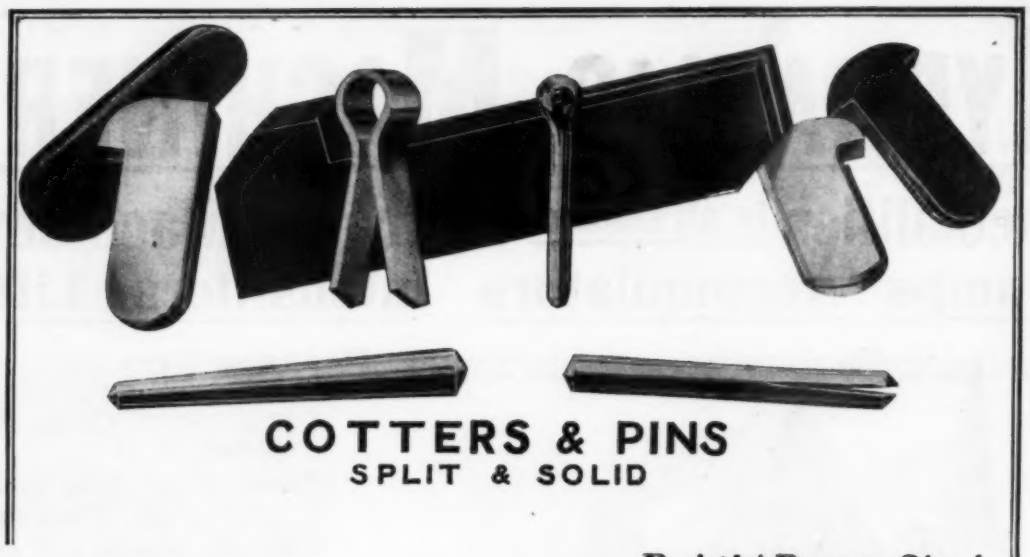

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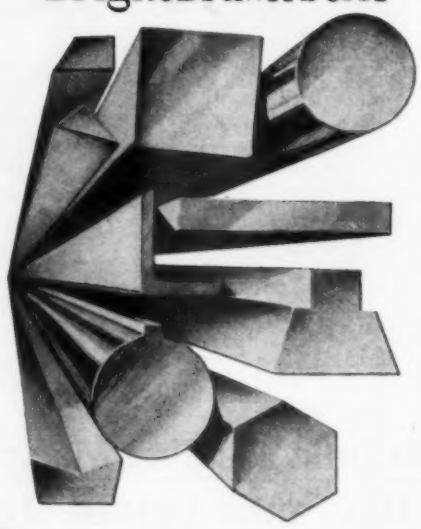

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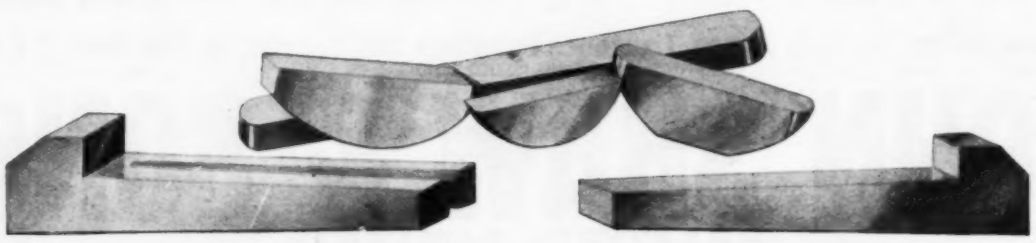

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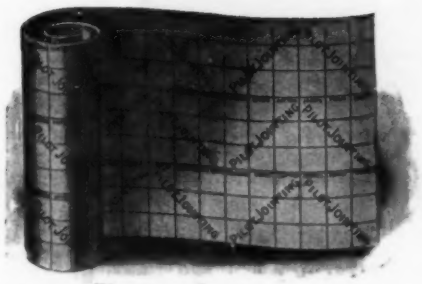

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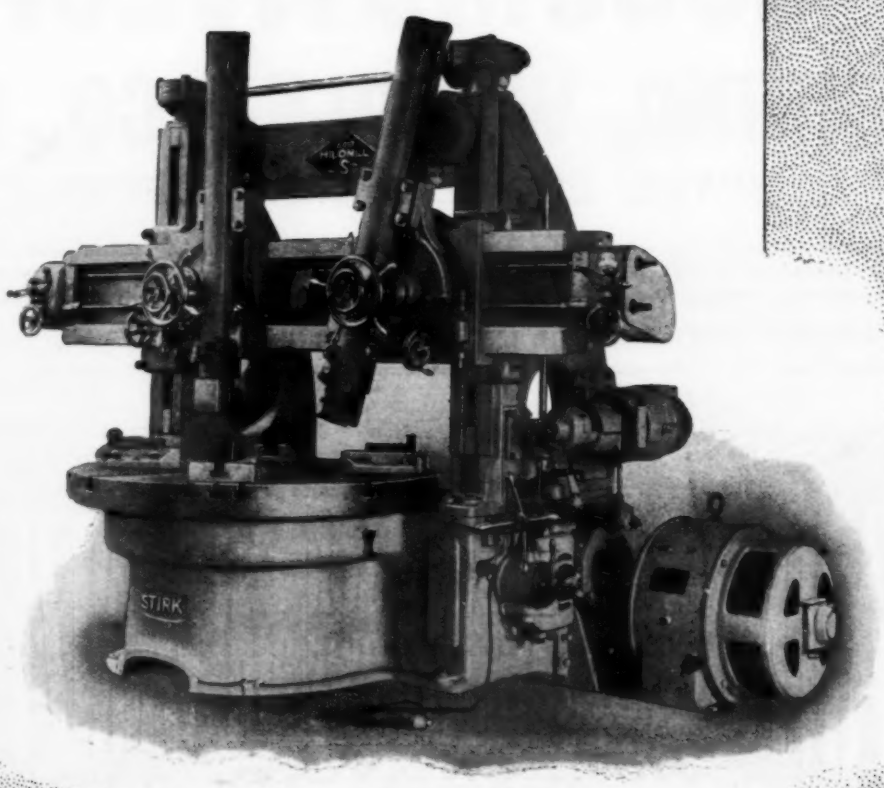

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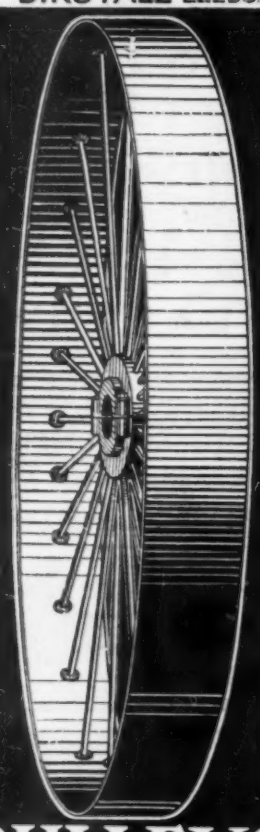

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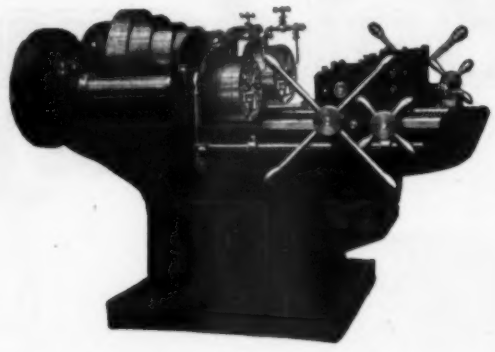

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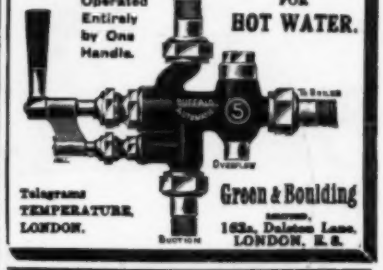

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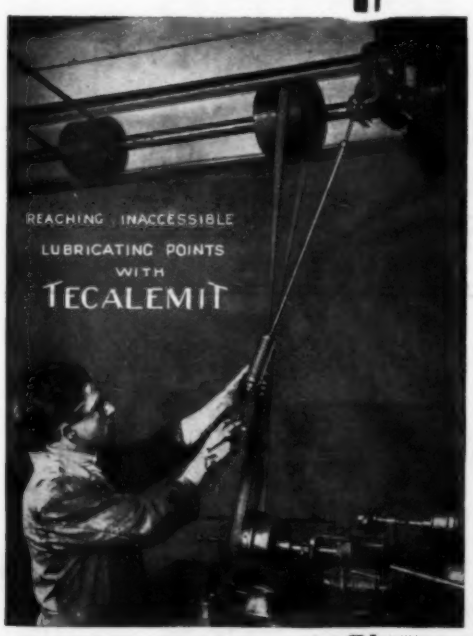

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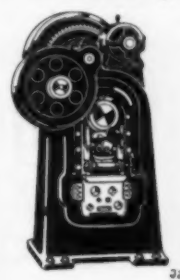

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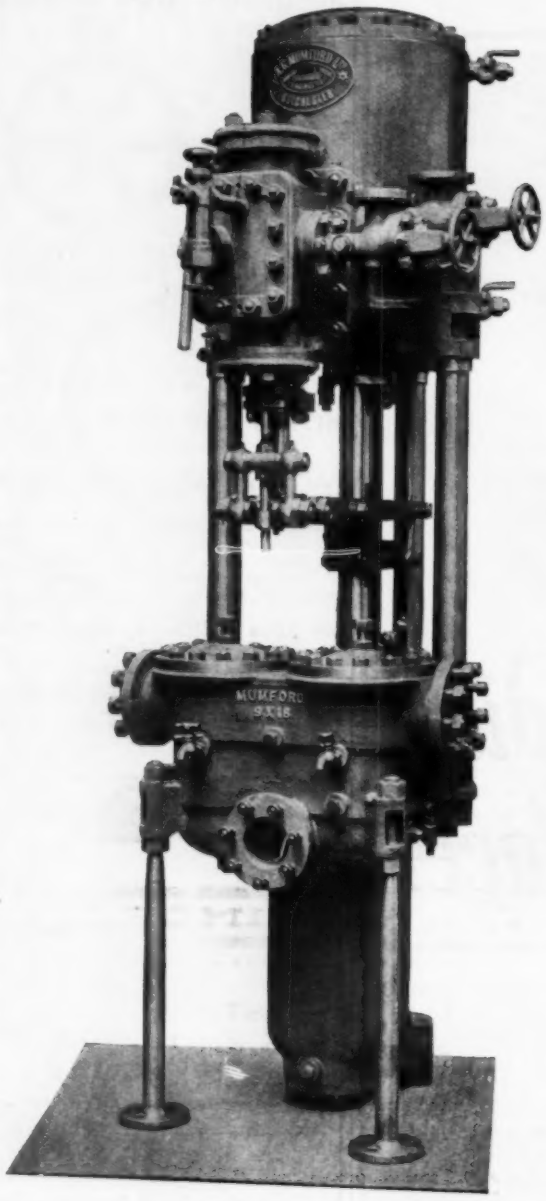

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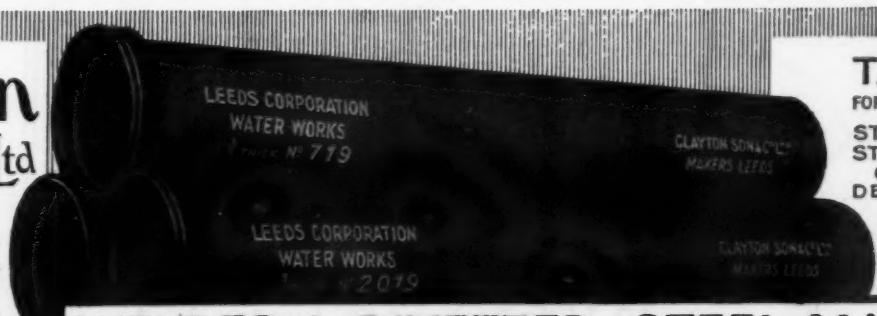

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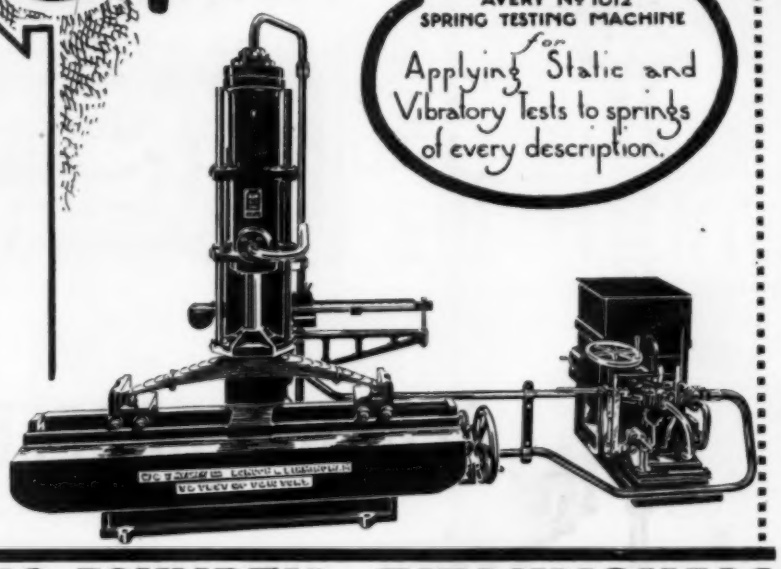

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Length of Table	3' 0"
Width of Table	2' 3½"
No. of Spindle Speeds...	12
No. of Feed Changes ...	18
Nett Weight	4 tons

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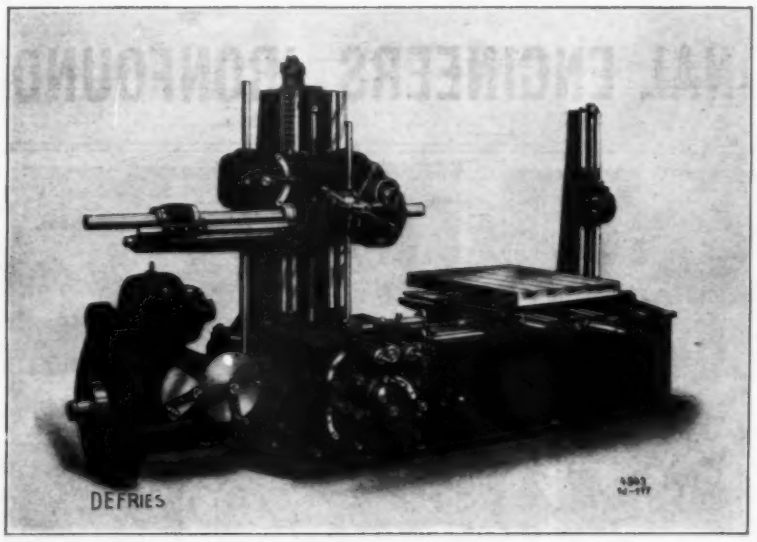

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Traverse of Spindle at one setting	2' 0"
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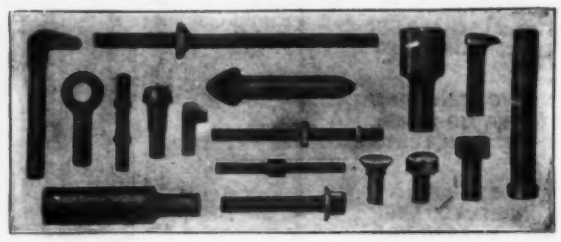

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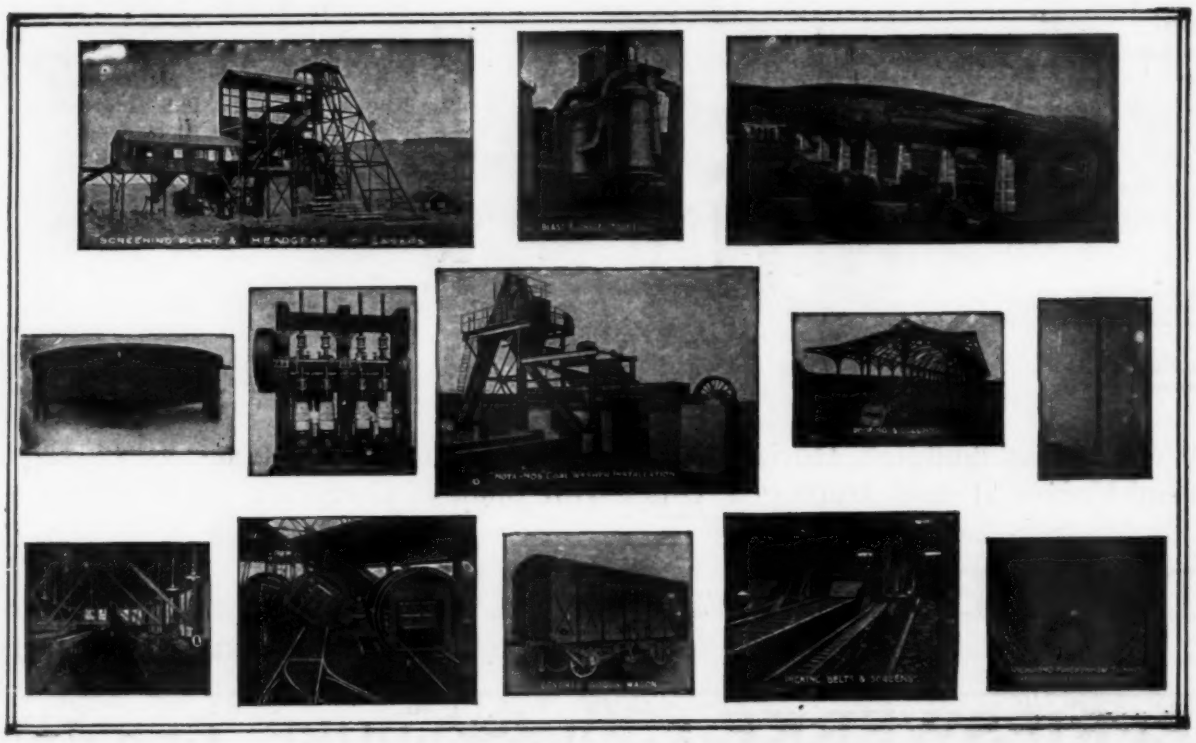

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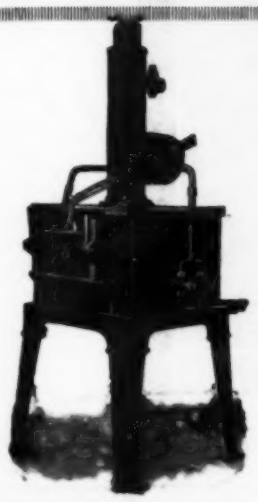

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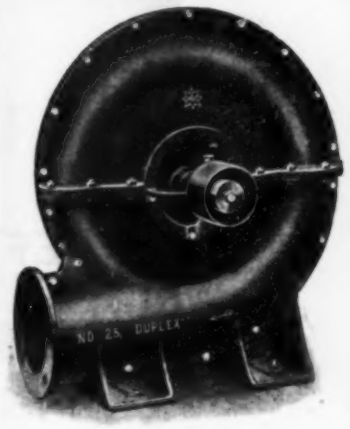

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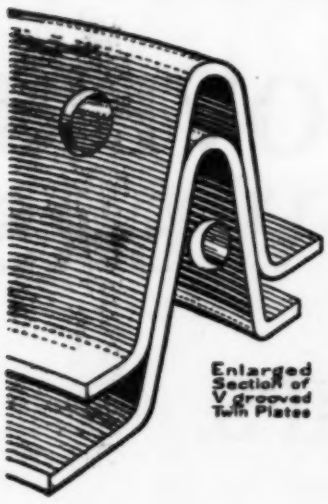

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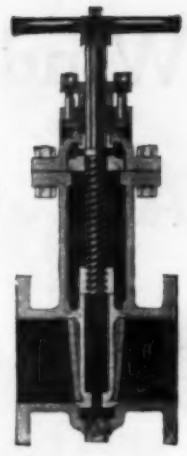

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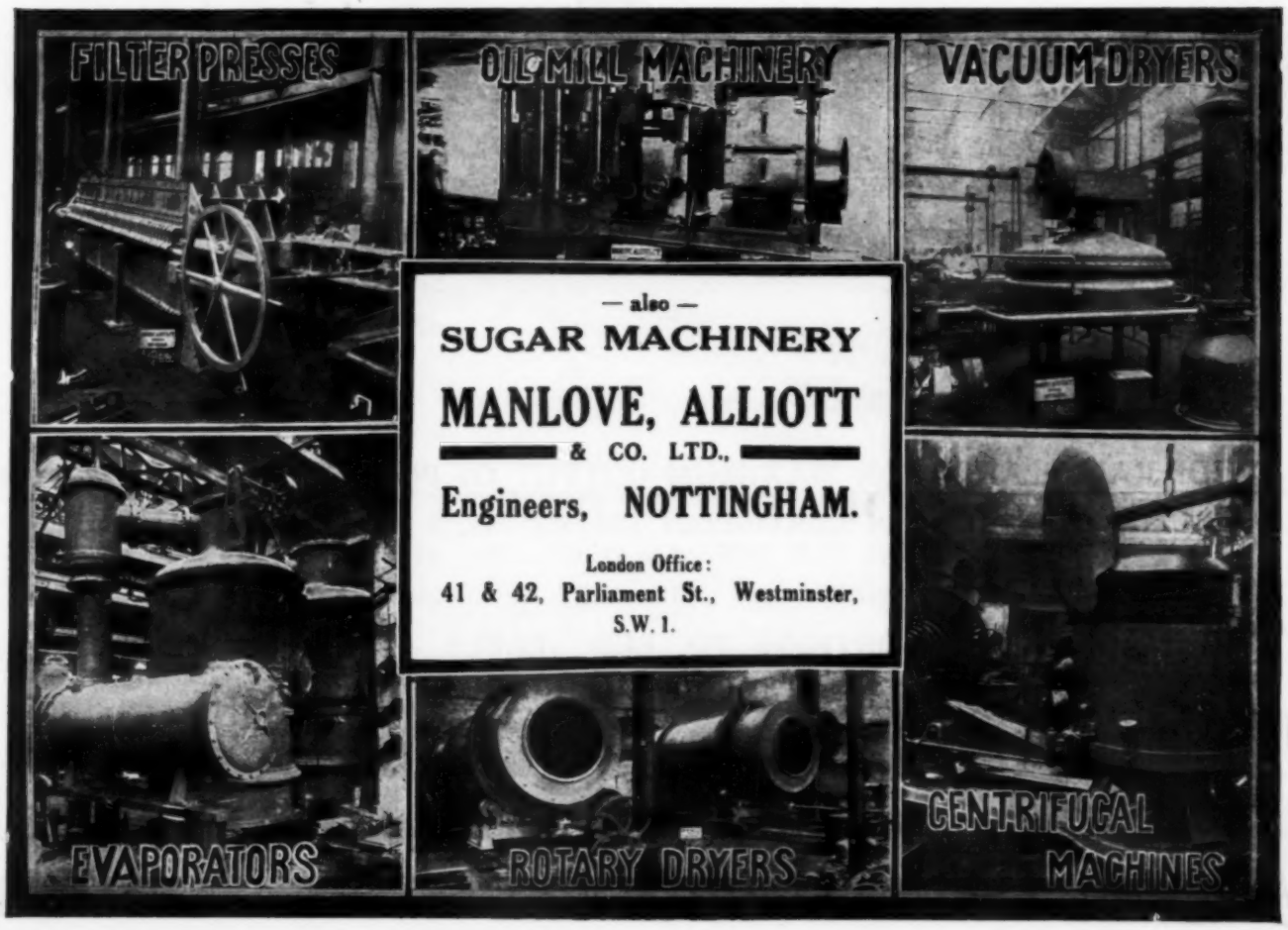

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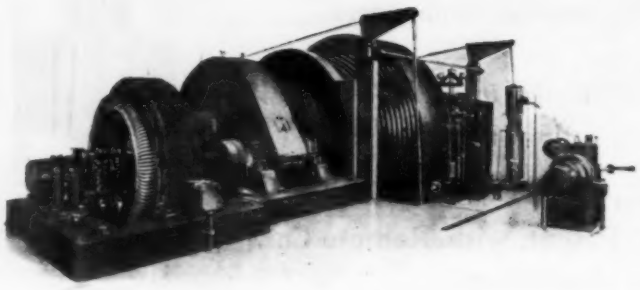

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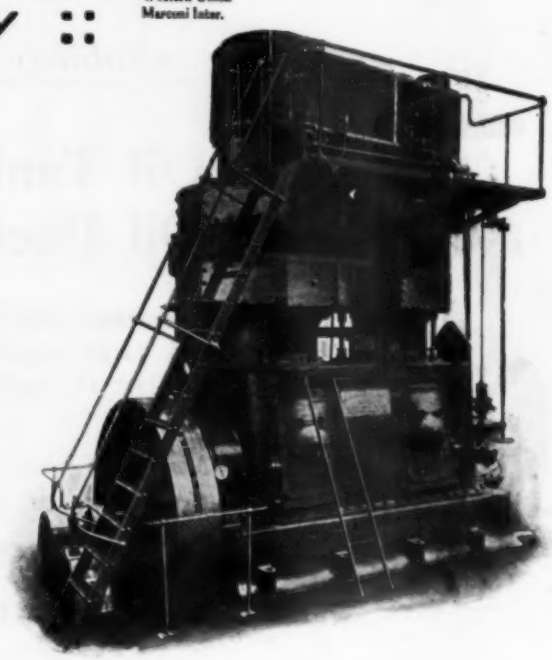

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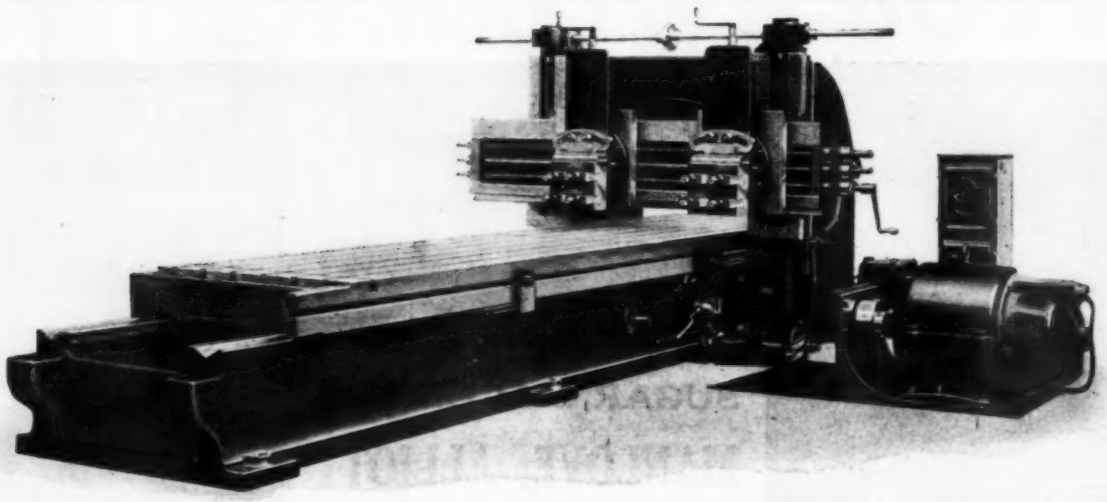

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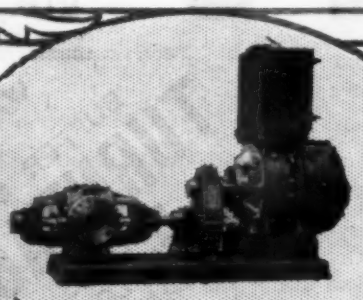

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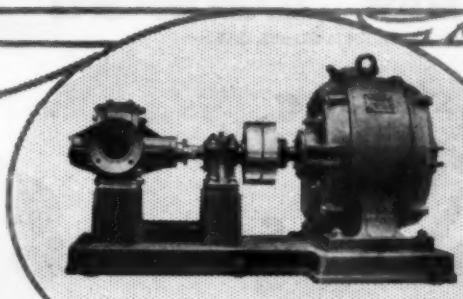

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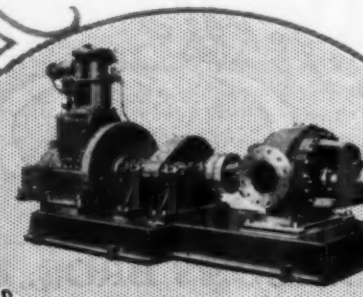

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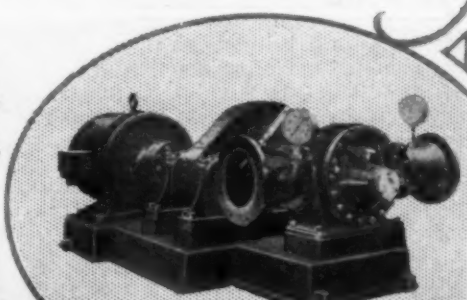

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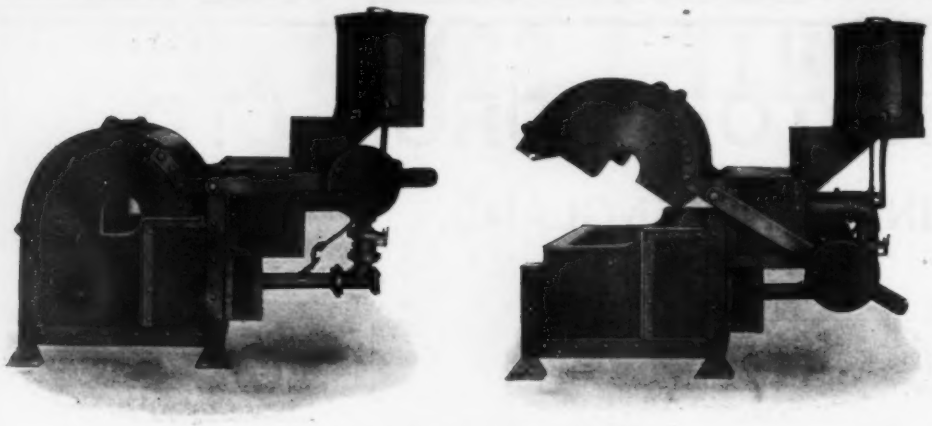

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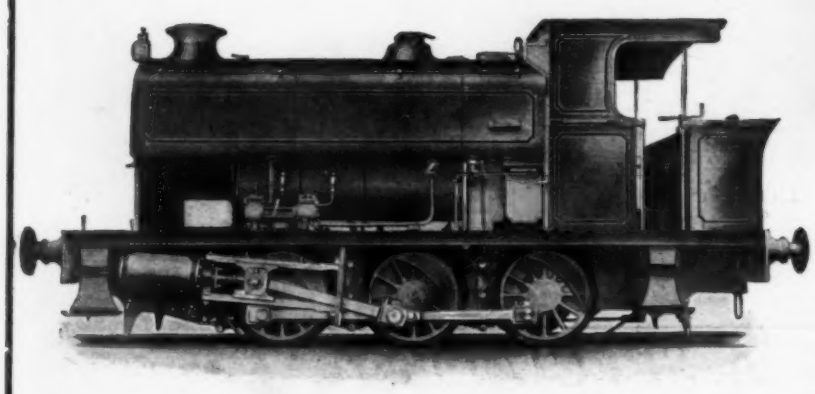

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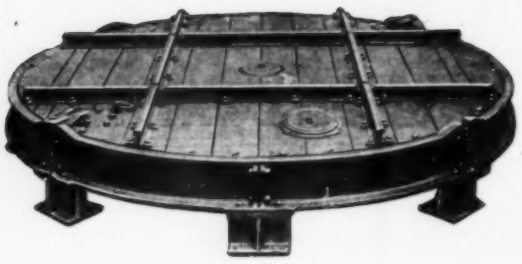

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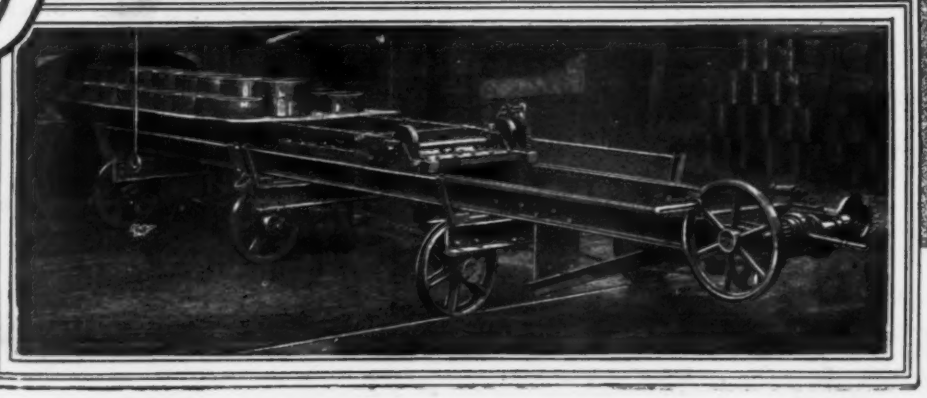

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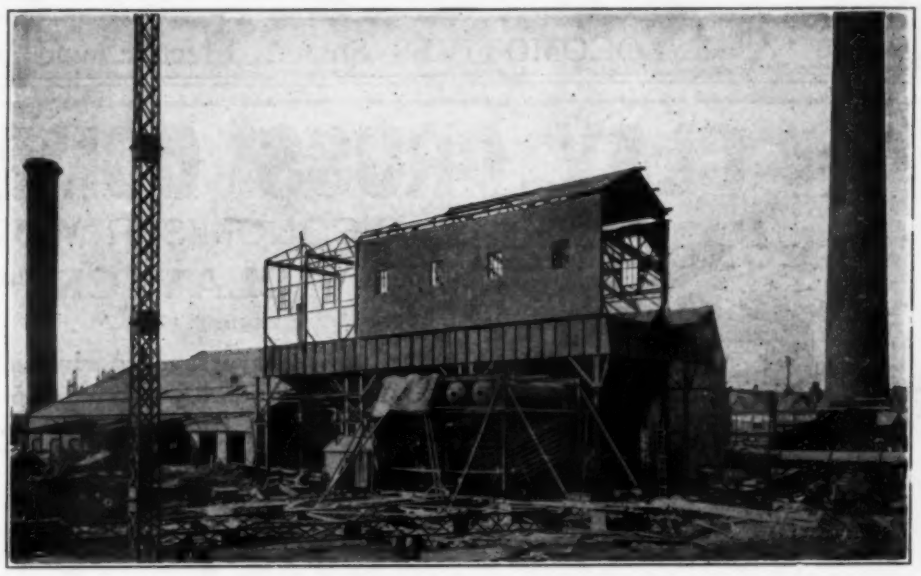

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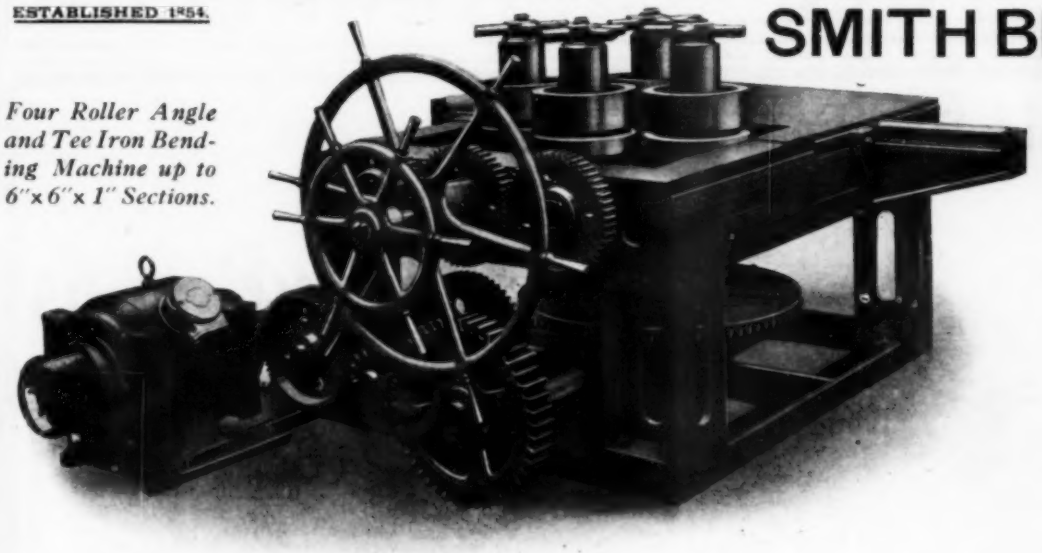

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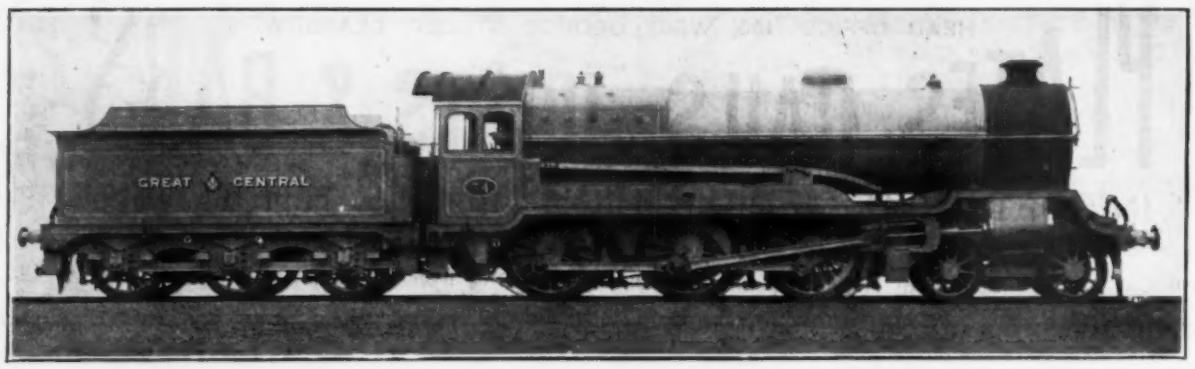

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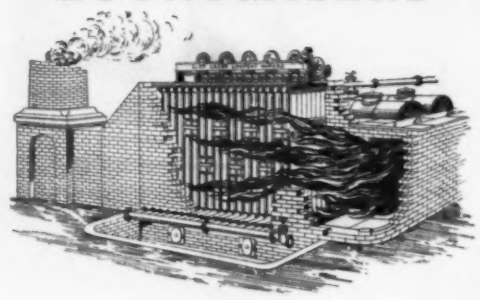

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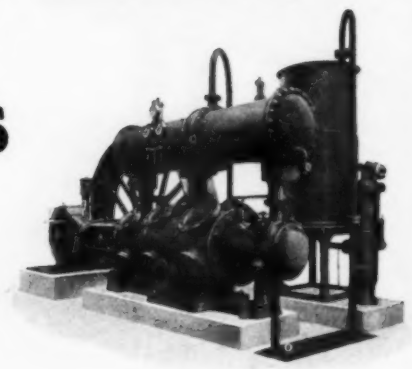

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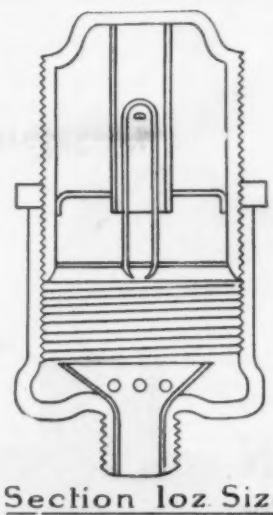

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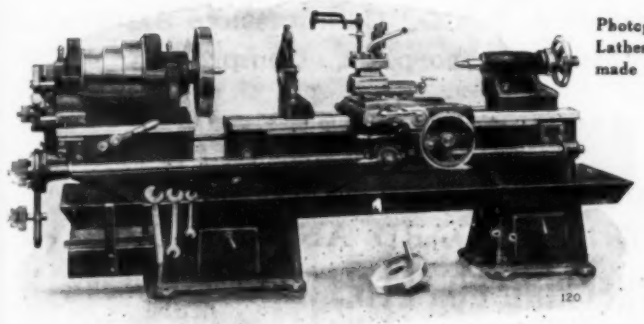

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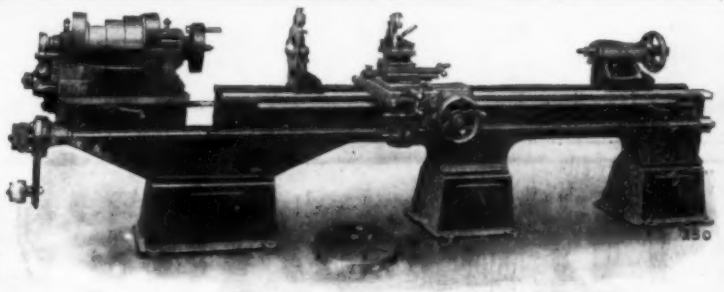

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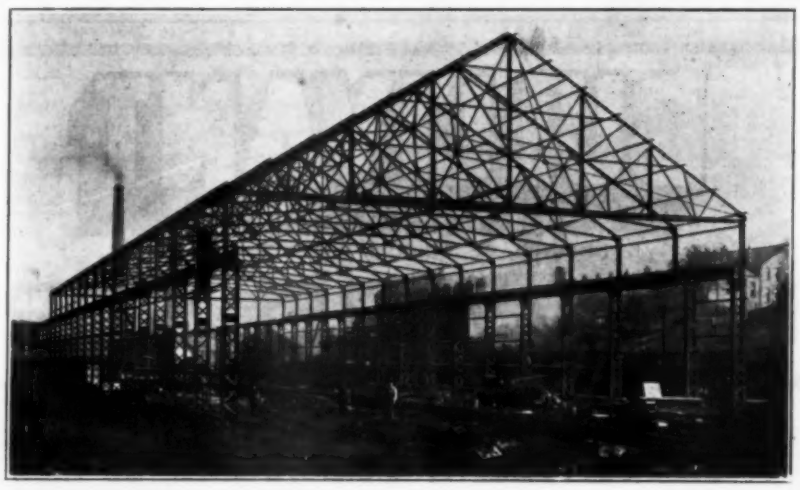

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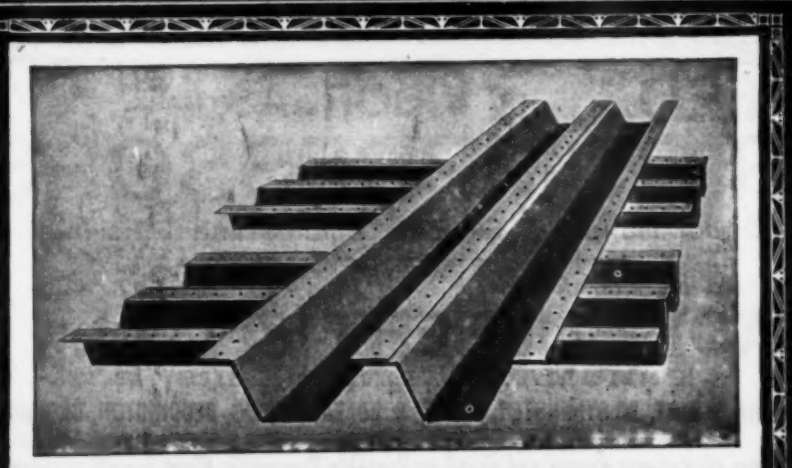

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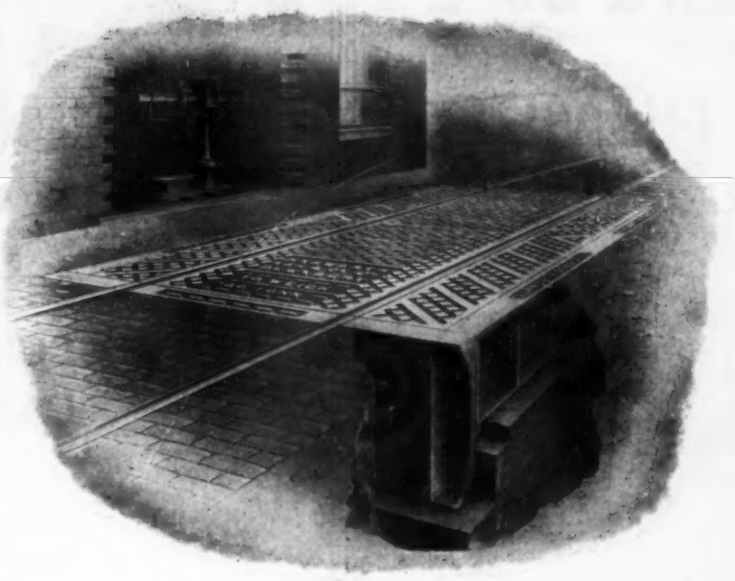

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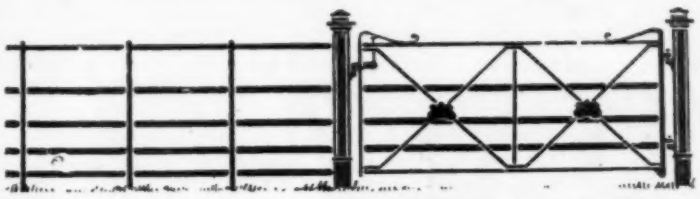

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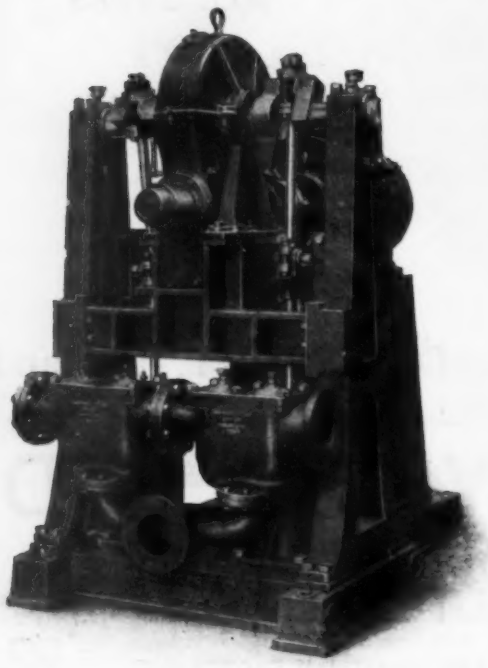

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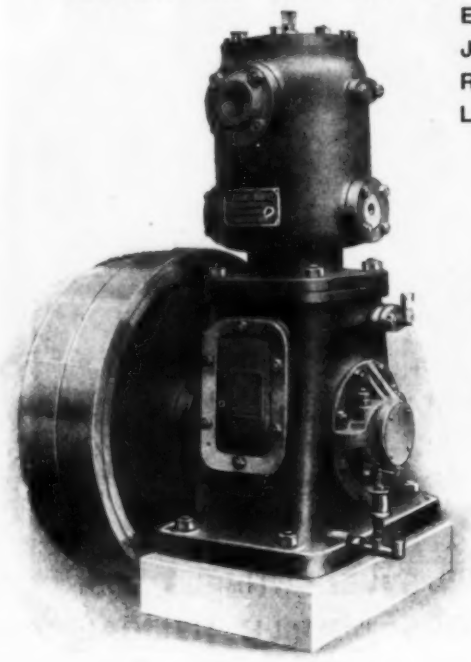

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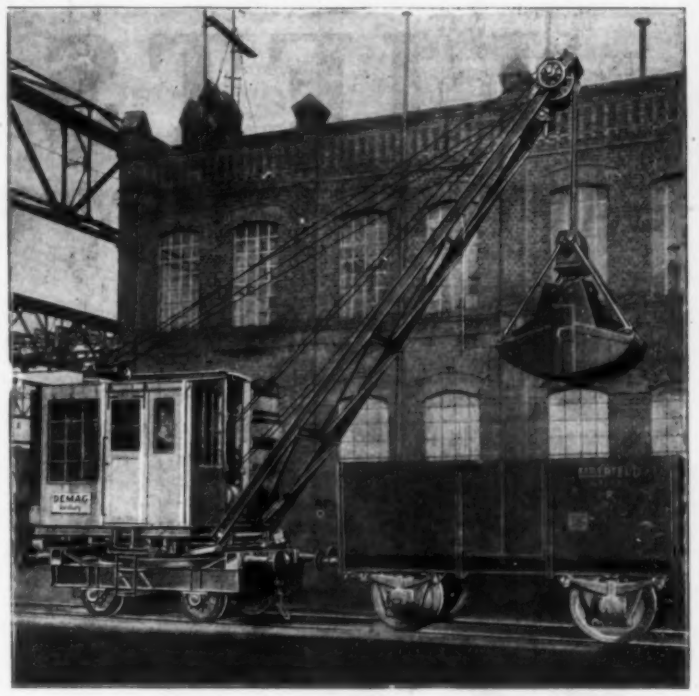

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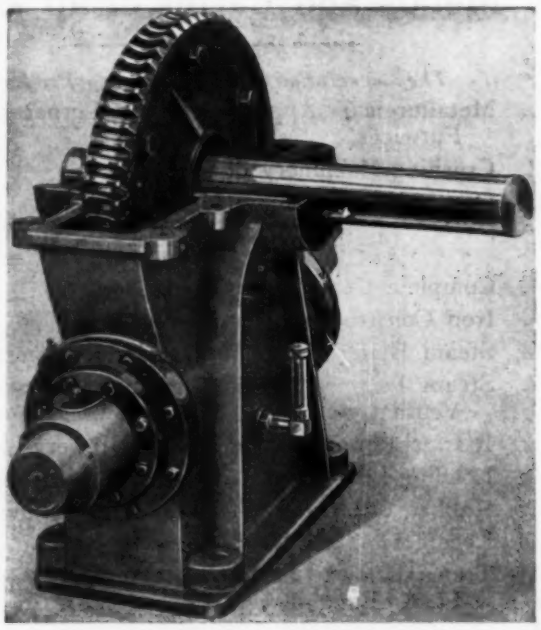

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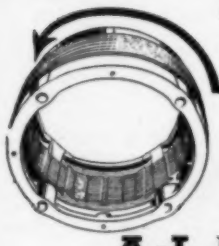

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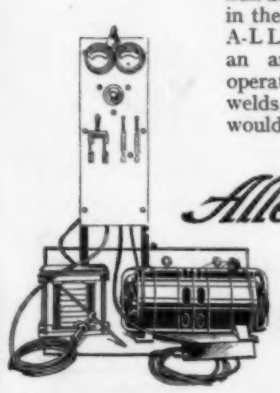

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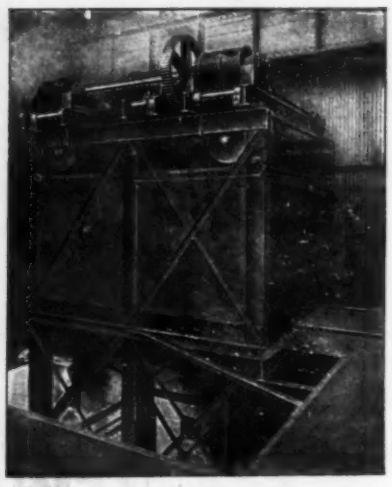

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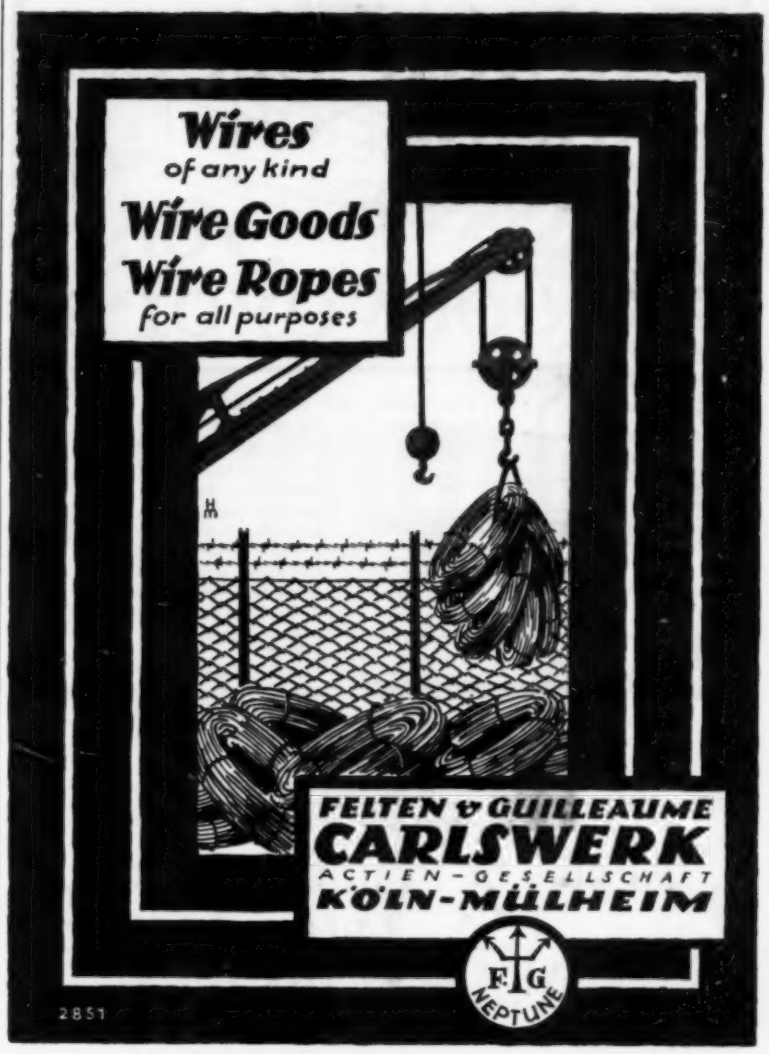

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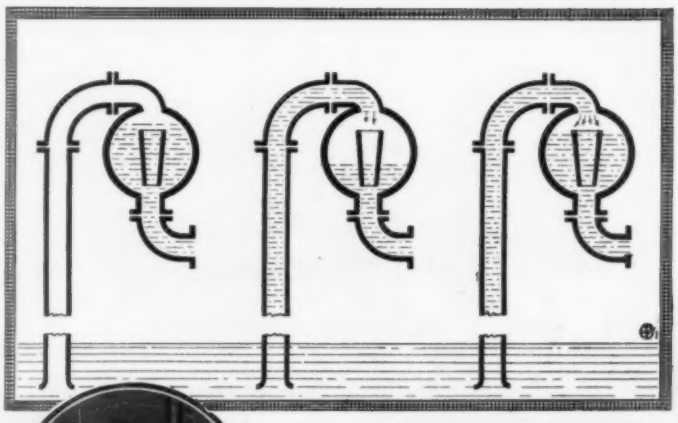

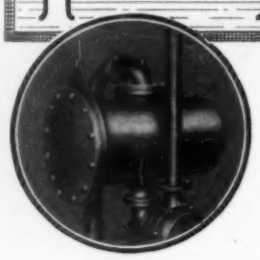

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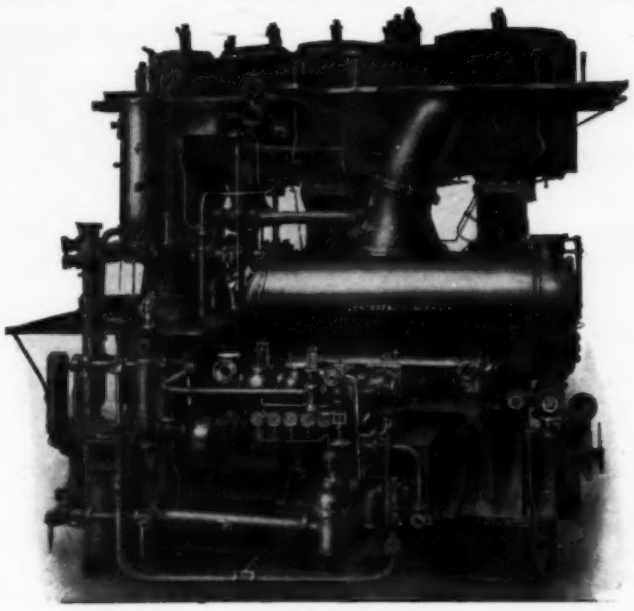

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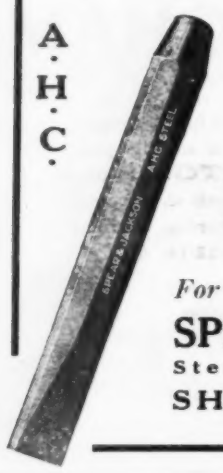

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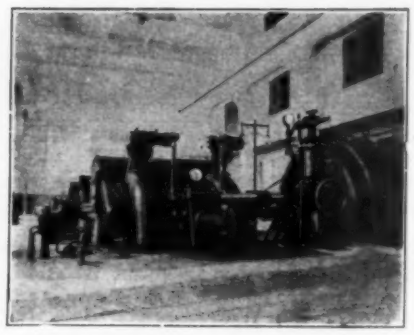

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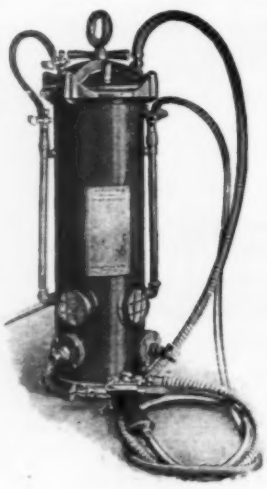

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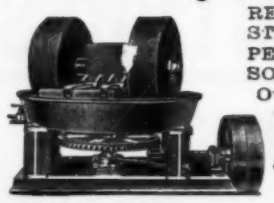

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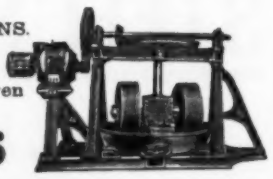

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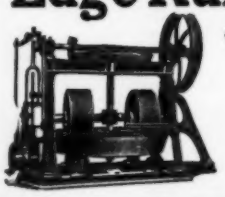

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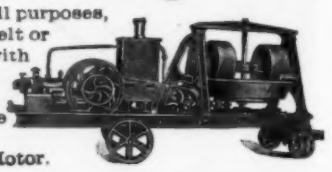

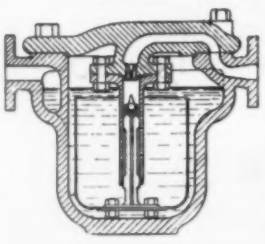

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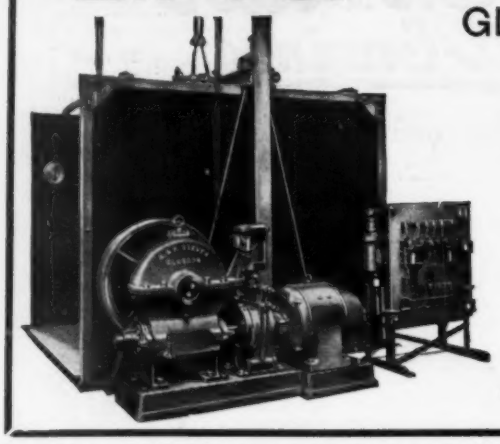

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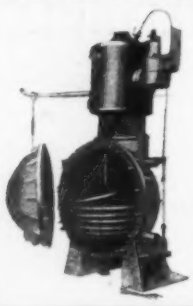

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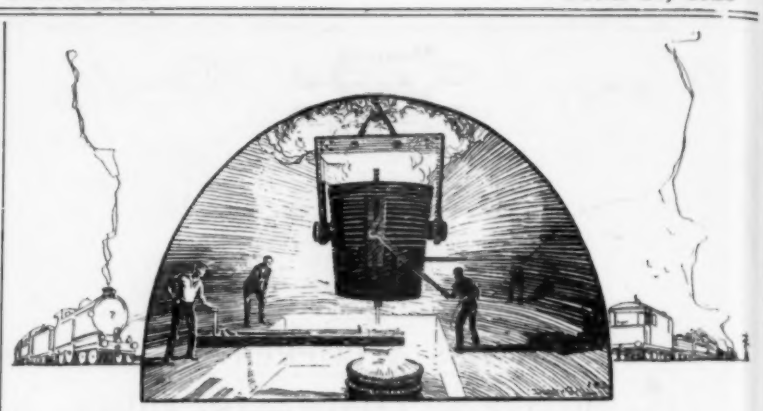

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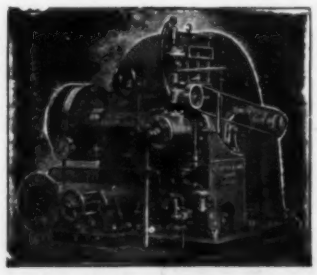

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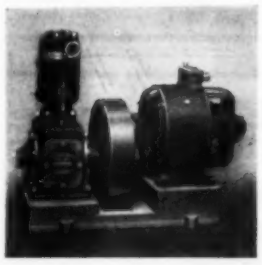

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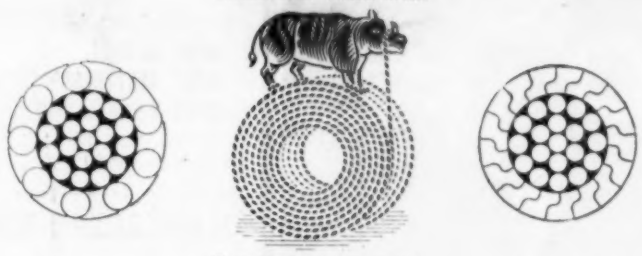

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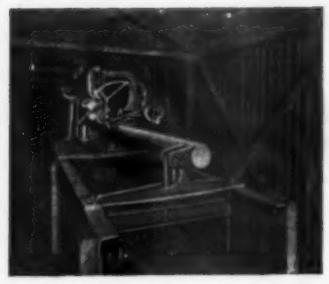

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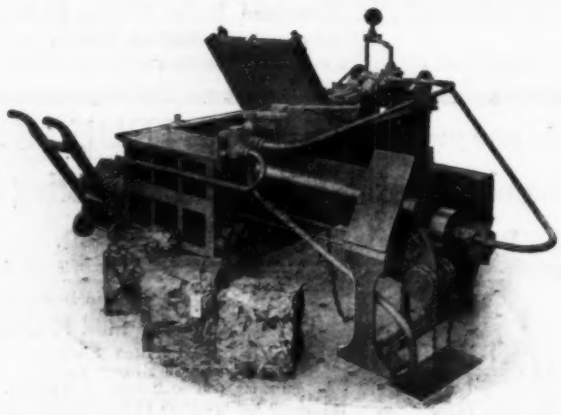

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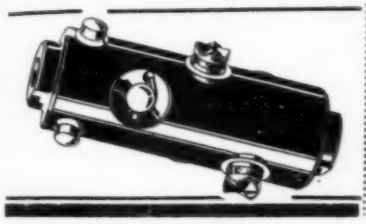

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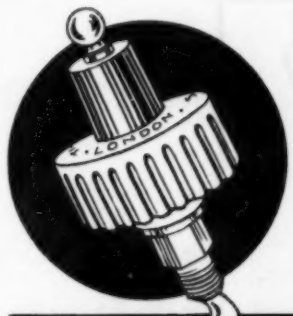

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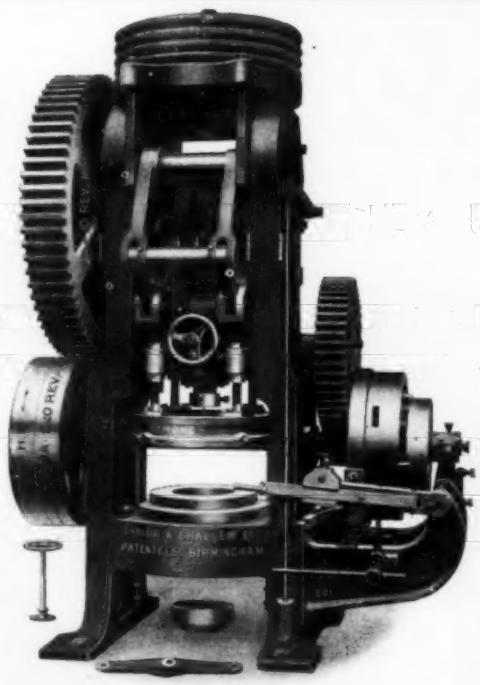

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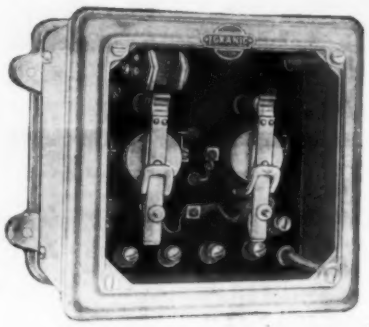

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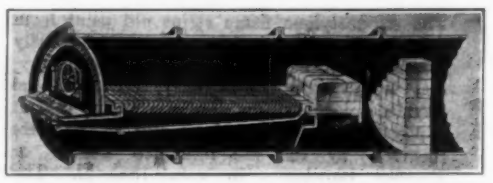

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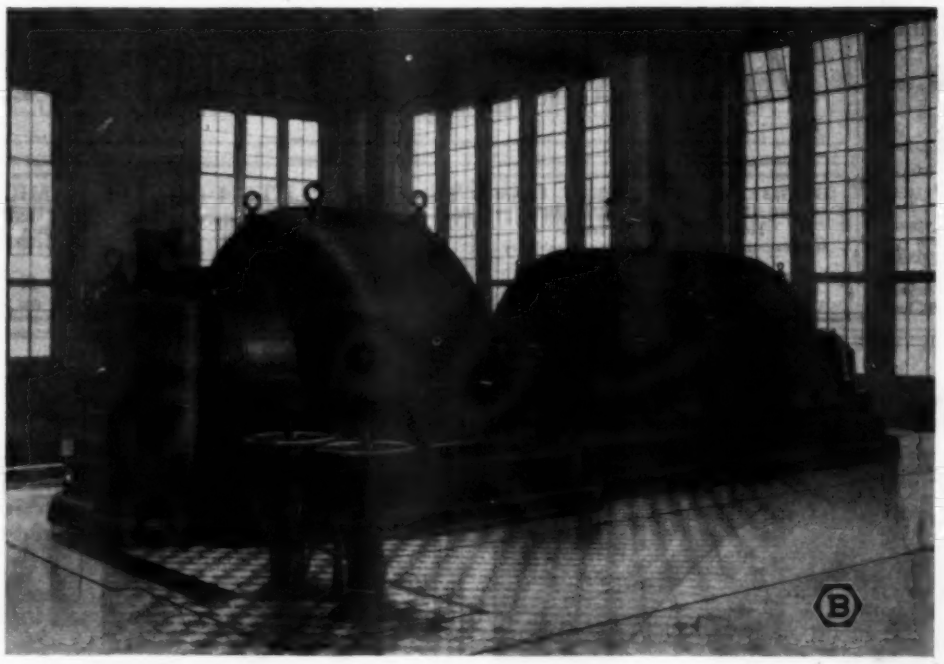

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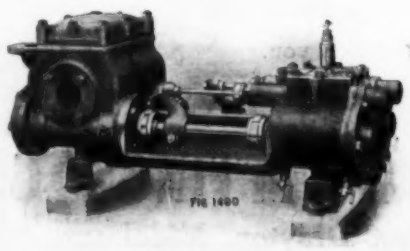

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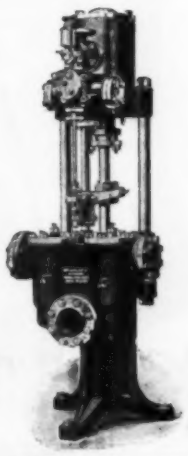

BOILER FEEDING.
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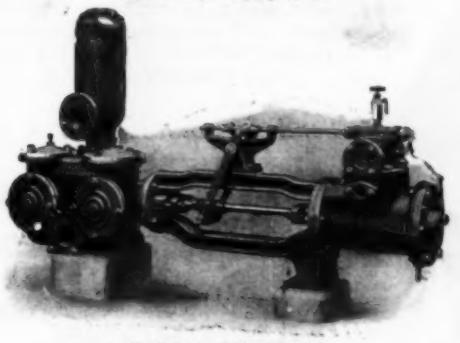

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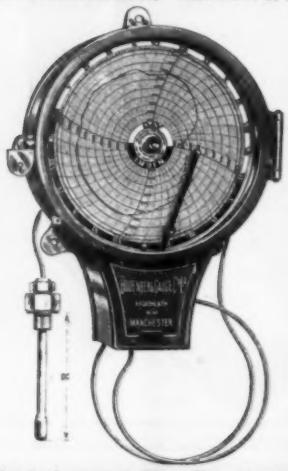

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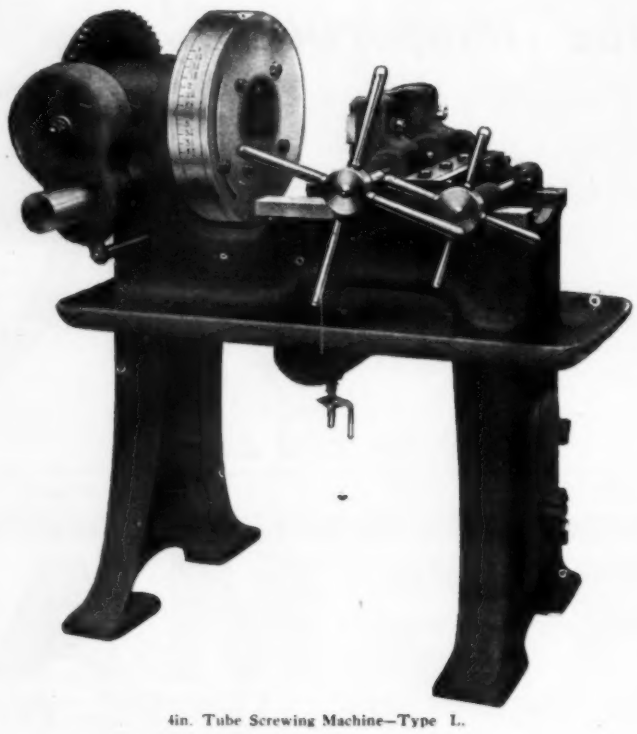

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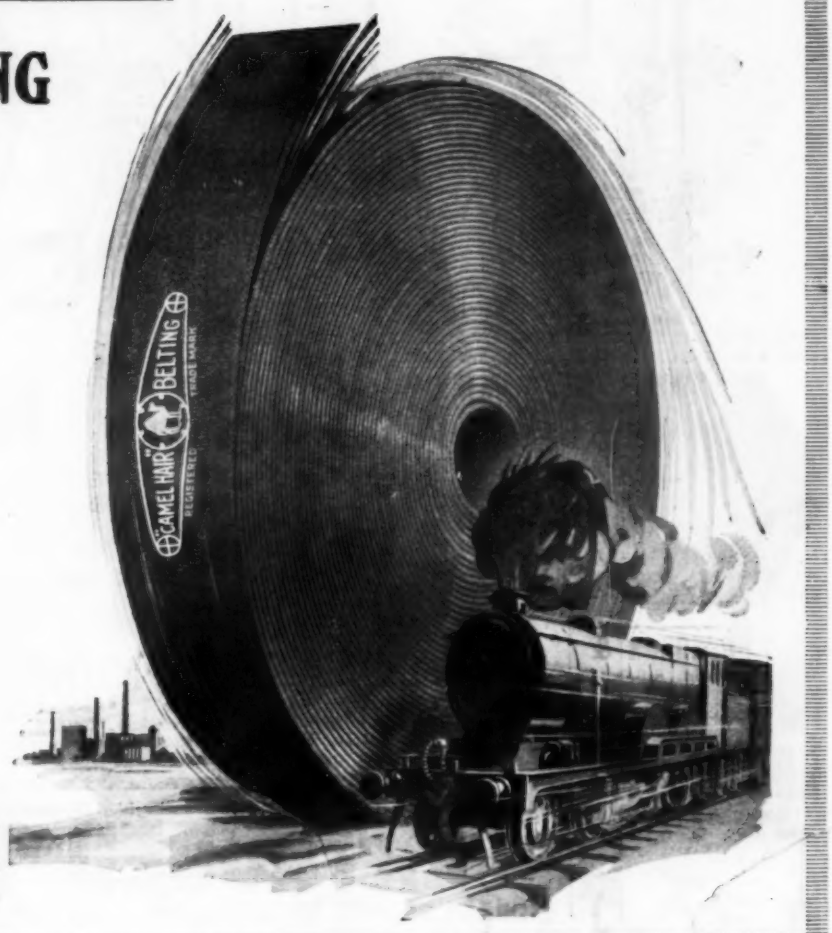

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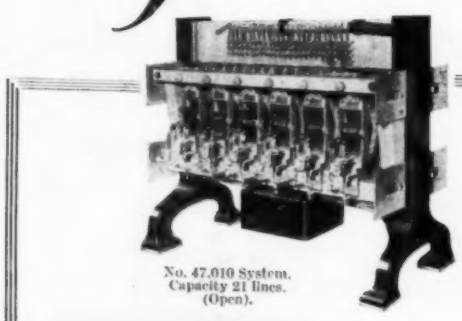

No. 47,010 System. Capacity 21 lines. (Open).

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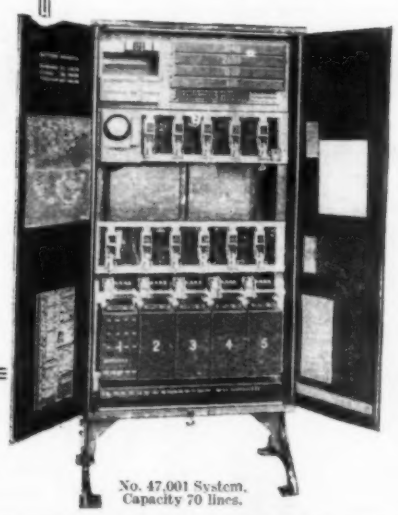

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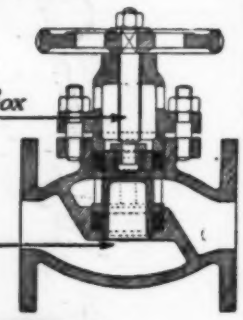

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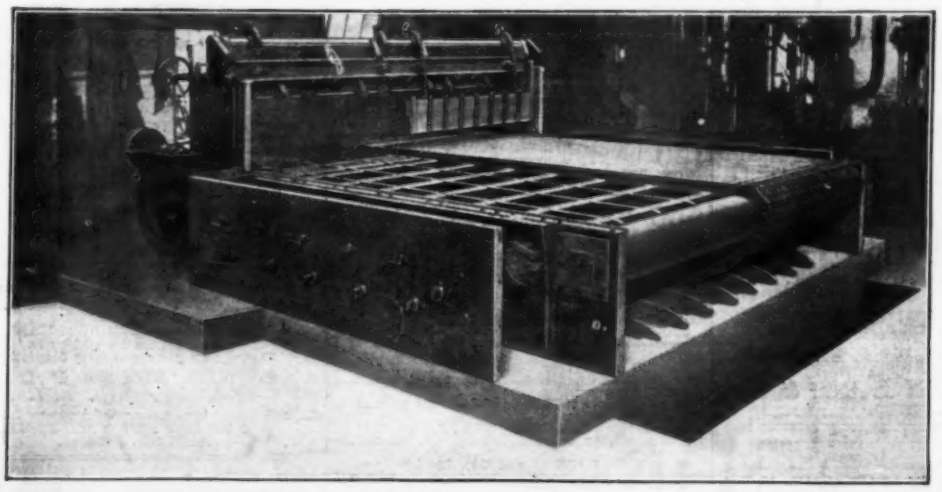

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